

# MONTHLY WEATHER REVIEW.

WASHINGTON, D. C., NOVEMBER, 1882.

## INTRODUCTION.

This REVIEW presents a general summary of the meteorological data collected by the Signal Service for the month of November, 1882.

An interesting feature in the meteorology of the month has been the magnetic storm that occurred in connection with the brilliant and widely observed auroral display of the 17th. Reports show that the auroral display was also observed throughout Europe, and that the attendant magnetic disturbance was perceptibly felt in that continent.

As a noteworthy feature of the month, may also be mentioned, the marked deficiency in the rainfall over the north Pacific coast region, and over New England and the middle Atlantic states.

That part of the REVIEW referring to International Meteorology, presents the general weather conditions which prevailed over the northern hemisphere during the month of September, 1880. The weather, during the month, differed but slightly from the normal, except in the amount of the rainfall, which was above the average in central Europe. Chart v. exhibits the path of barometric minima for December, 1880. A special feature of that chart is the unusually large number of depressions that appeared on the Pacific coast.

In the preparation of this REVIEW, the following data received up to December 20th, have been used; viz.: the regular tri-daily weather charts, containing the data of simultaneous observations taken at one hundred and thirty-six Signal Service stations and fourteen Canadian stations, as telegraphed to this office; one hundred and ninety-two monthly journals, and one hundred and seventy-nine monthly means from the former, and fourteen monthly means from the latter; two hundred and seventeen monthly registers from voluntary observers; fifty-five monthly registers from United States Army Post Surgeons; Marine Records; International Simultaneous Observations; Marine Reports, through the co-operation of the "New York Herald Weather Service;" abstracts of Ships' Logs, furnished by the publishers of "The New York Maritime Register;" monthly reports from the local weather services of Indiana, Iowa, Kansas, Nebraska, and Missouri, and of the Central Pacific railway company; trustworthy newspaper extracts; and special reports.

## BAROMETRIC PRESSURE.

[Expressed in inches and hundredths.]

The mean barometric pressure for the month of November,

1882, over the United States and Canada, is shown by the isobarometric lines (in black) on chart ii.

The region of highest mean pressure embraces parts of Utah, Colorado, and New Mexico, and is inclosed by the isobar of 30.30. The highest monthly barometric means, 30.44 and 30.33, have been reported from Pike's Peak, Colorado, and Salt Lake City, Utah, respectively. A large area extending from Washington Territory to northwestern Texas, is inclosed by the isobar of 30.25. From this region eastward, the mean pressures diminish gradually, and are lowest in New England and the Canadian maritime provinces; the lowest monthly mean, 29.95, is reported from Sydney, Nova Scotia. The isobar of 30.15 extends through the lake region to the Atlantic, and thence along the Atlantic and Gulf coasts to the west Gulf states. Westward and southwestward of the region of highest pressure, the monthly means decrease rapidly, and are lowest in southern Arizona, where the lowest means reported are 30.04, at Yuma, and 30.06 at Tucson.

Compared with the means of the previous month, the pressure is higher in all districts, except in New England. The most marked increase occurs in the Rocky mountain regions, where the pressure is from 0.20 to 0.40 higher. On the Pacific coast, the increase ranges from 0.04 to 0.21. From the Mississippi river eastward to the middle and south Atlantic states, the increase varies from 0.05 to 0.22. In New England, the pressure is from 0.01 to 0.05 lower, except at Boston, Massachusetts, where there is no change.

## DEPARTURES FROM THE NORMAL VALUES FOR THE MONTH.

Compared with the November means of previous years, the pressure is from 0.02 to 0.07 below the normal from New England southwestward to the Mississippi river. In the lake region and from the Mississippi westward to the Rocky mountains, the pressure is from normal to 0.11 above. On the Pacific coast, the departures vary from normal to 0.06 below.

## BAROMETRIC RANGES.

Throughout the country the barometric ranges have varied from 0.45 at Fort Grant and Tucson, Arizona, and 0.49 at San Diego, California, to 1.07 at Eastport, Maine, 1.10 at Alpena, Michigan, and 1.20 at Pike's Peak, Colorado. In the several districts the ranges have been as follows:

*New England:* From 0.83 at Provincetown, Massachusetts, to 1.07 at Eastport, Maine.

*Middle Atlantic states:* From 0.67 at Norfolk, Virginia, to 0.96 at Albany, New York.

*South Atlantic states:* From 0.60 at Charlotte, North Carolina, and 0.61 at Augusta, Georgia, to 0.87 at Hatteras, North Carolina.

*Florida peninsula:* From 0.68 at Key West, to 0.76 at Cedar Keys.

*East Gulf states:* From 0.79 at Starkville, Mississippi, and Montgomery, Alabama, to 0.94 at New Orleans, Louisiana.

*West Gulf states:* From 0.64 at Fredericksburg, Texas, to 0.85 at Galveston, Texas, and 0.88 at Port Eads, Louisiana.

*Rio Grande valley:* From 0.74 at Brownsville, Texas, to 0.75 at Eagle Pass, Texas.

*Ohio valley and Tennessee:* From 0.53 at Louisville, Kentucky, to 0.74 at Pittsburg, Pennsylvania, and 0.77 at Memphis, Tennessee.

*Lower lake region:* From 0.73 at Cleveland, Ohio, to 0.90 at Oswego, New York.

*Upper lake region:* From 0.90 at Chicago, Illinois, and Port Huron, Michigan, to 1.02 at Escanaba, Michigan, and 1.10 at Alpena, Michigan.

*Extreme northwest:* From 0.75 at Fort Stevenson, Dakota, to 0.96 at Fort Buford, Dakota.

*Upper Mississippi valley:* From 0.58 at Cairo, Illinois, and 0.66 at Saint Louis, Missouri, to 1.03 at La Crosse, Wisconsin.

*Missouri valley:* From 0.64 at Springfield, Missouri, to 0.90 at Huron, Dakota.

*Northern slope:* From 0.54 at Fort Custer, Montana, to 0.76 at North Platte, Nebraska.

*Middle slope:* From 0.68 at Fort Elliott, Texas, and 0.71 at Denver, Colorado, to 1.20 on the summit of Pike's Peak, Colorado.

*Southern slope:* From 0.52 at Fort McKavett, Texas, to 0.75 at Fort Sill, Indian Territory.

*Southern plateau:* From 0.45 at Fort Grant and Tucson, Arizona, to 0.68 at Santa Fé, New Mexico.

*Middle plateau:* From 0.69 at Winnemucca, Nevada, to 0.84 at Salt Lake City, Utah.

*Northern plateau:* From 0.64 at Fort Missoula, Montana, to 0.85 at Boise City, Idaho, and 0.86 at Umatilla, Oregon.

*North Pacific coast region:* From 0.77 at Roseburg, Oregon, to 0.91 at Olympia, Washington Territory.

*Middle Pacific coast region:* From 0.60 at San Francisco, California, to 0.62 at Cape Mendocino, California.

*South Pacific coast region:* From 0.49 at San Diego, California, to 0.57 at Visalia, California, and 0.67 at Yuma, Arizona.

#### AREAS OF HIGH BAROMETER.

Six areas of high barometer have been sufficiently defined to merit description. These have all first appeared on the northern boundary of the United States, from Lake Superior to the Pacific coast. Of these, three, i., iii., and v., had an easterly path; ii. and vi., which were associated with cold waves, producing great temperature changes, had a southerly path.

I.—On the 1st, there extended over the northwest and upper lake region, an area of high-pressure central in Manitoba. The highest pressures reported were, Fort Garry, Manitoba, 30.66, Saint Vincent, Minnesota, 30.64, Huron, Dakota, and Moorhead, Minnesota, 30.63, Duluth, Minnesota, 30.61; all more than 0.5 inches above the mean. On the 2d, the high barometer was central north of the upper lake region; the highest pressure reported, observed at 3 p. m., was 30.7, at Marquette, Michigan, or 0.69 inches above the normal. On the 3d, the high area moved rapidly to the eastward, and at the end of the day was central over New England. On the 4th, the barometer rose slightly in New England, and in the maritime provinces of Canada. On the 5th, 6th, and 7th, with slight fluctuations, averaging nearly one-half inch above the mean; the high area remained over Maine and the maritime provinces. During the existence of this high-pressure, fair weather prevailed in the northwest and upper lake region, on the 1st, 2d, and 3d; in the Ohio valley, on the 2d, 3d, and 4th; in the lower lake region, on the 2d, 3d, 4th, and 5th; in the middle states, on the 3d, 4th, 5th, and 6th; in New England, on the 2d, 3d, 4th, 5th, and 6th. In connection with this high-pressure, with the barometer high in New England, and low in the Gulf of Mexico, the temperature fell below the mean for the month in the south Atlantic states, during the prevalence of the northeasterly winds. On the 2d, cautionary signals were displayed on the North Carolina and Virginia coasts, which were justified by the

following velocities: Hatteras, 42 ne.; Kittyhawk, 43 ne.; Cape Henry, 34 n.; Chincoteague, 33 ne.; on the 4th, cautionary signals were displayed from Macon, North Carolina, to Sandy Hook, New Jersey, and were justified by the following maximum velocities: Macon, 38 ne.; Hatteras, 44 ne.; Kittyhawk, 50 ne.; Cape Henry, 40 n.; Chincoteague, 32 n.; Delaware Breakwater, 43 ne.; Cape May, 27 n.; Atlantic City, 30 ne.; Barnegat, 38 ne.; Sandy Hook, 32 ne.

II.—On the 10th, there was a sharp rise in pressure in Idaho, Montana, and Dakota, in the rear of low area ii. On the 11th, the high area pressed to the southward. On the 12th, the rising barometer advanced to the Indian Territory and northern Texas. On the 13th, the high area extended over the Gulf states. On the 12th and 13th, while the pressure was rising east of the Rocky mountains, the centre of the high area, averaging 0.3 inch above the mean, was in Utah. For six of the tri-daily observations, the barometer at Salt Lake City was above 30.6 inches. This high pressure was, as is usual, associated with a cold wave. Many observed temperatures were 30° below the normal for the month. As the cold wave pressed southward, changes in temperature exceeding 40° for twenty-four hours were frequently reported. On the 10th, the region south of the Platte river was warned by telegraph of the approach of a "norther." For the protection of the sugar interests, frost warnings were also sent to New Orleans. In connection with this high pressure, the minimum temperatures for the month were generally reported from the Rocky mountain region. The following special temperatures were noted: Fort Washakie, Wyoming, -23°; Cheyenne, -15°; Pike's Peak, -26°. Cautionary signals displayed at Indianola and Galveston were justified by the following maximum velocities: Indianola, 52 n.; Galveston, 48 n.

III.—On the 15th, there was a very sharp rise of pressure in Idaho and Montana, which extended on the 16th into the Missouri valley. At the last observation of that day the isobar of 30.5 included the greater part of Minnesota, Dakota, Nebraska, and Kansas. On the 17th, the centre of high barometer was rapidly transferred to the Saint Lawrence valley, disappearing on the 18th beyond the coast. On the 17th, in connection with this high pressure, cautionary signals were ordered from Sandy Hook to Delaware Breakwater. On the 18th, from Chincoteague to Hatteras, and they were justified by the following velocities: Sandy Hook, 31 ne.; Barnegat, 30 ne.; Chincoteague, 30 nw.; Kittyhawk, 36 ne.; Hatteras, 38 ne.

IV.—While the high area described as iii. was moved to the eastward, the barometer continued above the mean in the northern part of the United States, west of the Missouri river. On the 16th, the highest pressures were reported from Washington Territory; on the 17th, from Idaho and Montana; on the 18th, from Nebraska and Kansas; on the 19th, the high pressure only slightly above the mean, was carried to the upper lake region.

V.—On the 22d, the barometer rose rapidly in the Missouri valley in rear of depression iv. On the 23d, the high area moved in a southeasterly track, and became central in Kansas. On the 24th, the region of highest pressure—the Ohio valley and Tennessee—was enclosed in the isobar of 30.4. On the 25th, the high pressure was in the middle states, and, on the 26th, disappeared beyond the limits of the chart in advance of a slight depression, not charted, then central in the lower lake region.

VI.—On the 26th, there was a very marked rise of the mercury in Washington and Idaho Territories. On the 27th, the high barometer extended from Idaho and Montana to Texas and the Indian Territory, being highest in Utah, where the pressure exceeded 30.5 inches. On the 28th, the isobar of 30.5 included Manitoba, Dakota, and Nebraska. On the 29th, the highest pressure was rapidly transferred to Texas, and on the 30th, the center of high barometer was in the Gulf states. The following are the maximum pressures in inches reported in connection with this high area: Indianola 30.66; Galveston, Eagle Pass, Palestine, and New Orleans 30.63. Associated with



this high-pressure were many of the minimum temperatures of the month in the west Gulf states and the region east of the Mississippi river. The temperature fell below freezing at Atlanta, Georgia; Montgomery and Mobile, Alabama; Pensacola, Florida; Vicksburg, Mississippi; and Shreveport, Louisiana.

#### AREAS OF LOW BAROMETER.

Five areas of low barometer have been sufficiently well defined to justify their charting, and the centres of depression have been located at each telegraphic report, from the first appearance of the low area until its dissipation, or disappearance beyond the stations of observation. The storm-tracks for the month of November, 1882, will be found on chart I. Two of the depressions, i. and ii., first appeared on the Pacific coast, moved in an easterly course over the Rocky mountains to the upper lake region, where i. was dissipated, and ii., turning to the northeast, moved beyond the limits of the observing stations.

Two areas of low barometer, iii. and v., which, in their course, developed into severe storms, were first observed near the mouth of the Rio Grande; they pursued very nearly the same track over the Gulf states, and then very nearly the same northeasterly path along the Atlantic coast.

The following table gives the number of areas of low-pressure noted in the November Weather Reviews since 1873, and the average hourly velocity of the low centres, in miles per hour:

Year.	No.	Hourly velocity.	Year.	No.	Hourly velocity.
1873	12	—	1878	14	21.2
1874	16	—	1879	15	40.7
1875	14	—	1880	16	34.1
1876	15	22.6	1881	16	30.8
1877	12	25.5	1882	5	27.7

The following table gives the latitude and longitude in which each area was first and last observed, and the average hourly velocity:

Areas of low barometer.	FIRST OBSERVED.		LAST OBSERVED.		Average velocity in miles per hour.
	Lat. N.	Long. W.	Lat. N.	Long. W.	
No. I.	45 00	123 30	43 30	57 30	25.6
II.	38 30	122 00	47 30	54 30	32.2
III.	27 30	97 00	43 00	59 30	25.6
IV.	44 30	104 00	47 00	58 00	25.7
V.	26 30	98 30	47 30	58 30	29.5
Mean hourly velocity.....					27.7

I.—On the 2d, there was a sudden fall in pressure on the coast of Oregon and Washington Territory, accompanied by light rains, which extended the next day southward to San Francisco and eastward to Idaho. From the morning of the 3d to the morning of the 4th, the centre of depression passed very rapidly from the Pacific coast to Dakota. On the 4th, the low area remained in Dakota and Minnesota, exhibiting but little energy. On the 5th and 6th, the depression moved slowly to the southeastward, with diminishing force, and on the latter day was, while central over Lake Michigan, filled up by the inflowing air. Cautionary signals were ordered on the 4th, in advance of this storm, for the ports of Lakes Superior and Michigan. The following are the maximum velocities reported: Duluth, 36 ne.; Escanaba, 26 se.; Milwaukee, 30 se.

II.—On the 8th, a depression accompanied by general rains throughout the state, entered California near San Francisco. On the 9th, the centre of low area, moving in an easterly track, crossed the Rocky mountains. On the 10th, the depression, slowly increasing in energy, moved into Iowa; on the 11th, the storm-centre moved in a northeasterly path to the upper lake region, and, on the 12th, disappeared beyond the limits of the chart. This depression was followed by the high-pressure described as ii, and which was accompanied by the cold wave

which produced the greatest temperature change of the month in the south. Cautionary signals were ordered to be displayed in advance of this storm on the 10th and 11th instants for all the lakes. The following are the maximum velocities reported: Duluth, 44 ne.; Marquette, 25 e.; Milwaukee, 33 sw.; Grand Haven, 33 s.; Mackinac City, 27 sw.; Alpena, 31 se.; Port Huron, 26 w.; Detroit, 27 s.; Toledo, 27 sw.; Sandusky, 37 nw.; Erie, 28 nw.; Buffalo, 28 sw.; Rochester, 31 w.; Oswego, 28 w. Cautionary signals were ordered for exposed ports on the New England coast on the 11th. The following are the maximum velocities reported: Eastport, 35 ne.; Thatcher's Island, 30 s.; Provincetown, 25 s.; Block Island, 39 sw.

III.—On the 18th, there was a fall in pressure near the mouth of the Rio Grande, it was accompanied by general rains and northeasterly winds in Texas. On the 19th, the storm-centre moved with considerable energy in a northeasterly track. On the 20th, it moved over the southern parts of Alabama and Georgia, and, at the midnight observation, the centre of low area was southeast of Savannah, Georgia. On the 21st, the storm-centre, increasing in energy, changed its path to the southeast, with high northeast, backing to northwest winds, on the South and North Carolina coasts. Reports from Nova Scotia and marine observations show the path of the storm, as charted, on the 22d and 23d. In connection with this storm-centre on the 18th, cautionary signals were ordered at Indianola, Galveston, and Port Eads; on the 19th, from New Orleans to Cape Henry. The following are the maximum velocities reported: Indianola, 35 n.; Galveston, 40 nw.; Port Eads, 44 nw.; New Orleans, 25 se.; Cedar Keys, 28 e.; Savannah, 28 ne.; Charleston, 26 ne.; Smithville, 32 ne.; Macon, 34 ne.; Hatteras, 40 ne.; and Kittyhawk, 38 ne.

IV.—On the 21st, a depression was developed in Wyoming and Dakota, but without any display of storm energy. On the 22d, with a considerable increase in storm intensity, the centre of low area moved into Iowa. The depression was accompanied in its south and east quadrants by fair weather, and in its north and west quadrants, by general snows. On the 23d, as it moved in a northeasterly track over the upper lake region, the storm-centre received a sudden and great increase of energy. On the 24th and 25th, the depression moved, as charted, over the Saint Lawrence valley and the Maritime Provinces beyond the coast. It was remarkable, for a storm of such energy, that the precipitation should have been confined so near to the centre of low area. Cautionary signals were ordered in advance of this storm on the 22d, for Lake Michigan, and on the 23d, for Lakes Huron and Ontario. Cautionary northwest signals were ordered for Lake Erie on the 23d. The following are the maximum wind-velocities reported: Milwaukee, 36 w.; Grand Haven, 52 nw.; Mackinac City, 28 nw.; Toledo, 38 sw.; Sandusky, 42 nw.; Cleveland, 31 w.; Erie, 45 nw.; Buffalo, 56 w.; Rochester, 36 w.; Oswego, 27 nw. Cautionary signals were ordered on the 23d, from Chincoteague to Hatteras, and cautionary or cautionary off-shore signals, on the 24th, on the Atlantic coast from Eastport to Delaware Breakwater. The following are the maximum wind-velocities reported: Eastport, 35 se., and 30 nw.; Portland, 25 nw.; Thatcher's Island, 44 w.; Boston, 30 nw.; Provincetown, 32 nw.; Newport, 34 w.; Block Island, 40 nw.; New York, 25 w.; Sandy Hook, 35 w.; Barnegat, 39 w.; Cape May, 55 w.; Delaware Breakwater, 40 nw.; Chincoteague, 54 nw.; Cape Henry, 45 nw.; Hatteras, 25, n.

V.—On the 25th, the pressure fell in southwestern Texas, and, at the morning observation of the 26th, a depression was developed near the mouth of the Rio Grande; during the day it moved slowly to the eastward and south of Indianola and Galveston. On the 27th, pursuing the same direction, the storm area entered the east Gulf states. At the morning report of the 28th, the storm-centre was near Savannah. The depression then developed a great increase of energy, and turned to the northeast, moving nearly parallel to the south Atlantic coast. At the midnight observation the lowest pressures reported were: Hatteras, 29.54; Kittyhawk, 29.59, or 0.67 and

0.64 inches below the normal respectively. On the 29th, the centre of low area moved nearly parallel to the north Atlantic coast, where high northeasterly gales, with snow, prevailed. The storm was evidently very heavy at sea. Cautionary signals displayed on the Texas coast were justified by the following velocities: Indianola, 32 nw.; Galveston, 36 n. Cautionary signals were displayed in advance of this storm on the Atlantic coast on the 27th, from Jacksonville to Kittyhawk; on the 28th from Cape Henry to Provincetown; on the 29th from Boston to Eastport. The following are the maximum velocities reported: Savannah, 25 ne.; Charleston, 28 ne.; Smithville, 31 ne.; Macon, 48 n.; Hatteras, 38 nw.; Kittyhawk, 45 ne.; Cape Henry, 56 nw.; Chincoteague, 40 ne.; Delaware Breakwater, 45 ne.; Cape May, 40 nw.; Atlantic City, 30 ne.; Barnegat, 37 ne.; Sandy Hook, 39 ne.; Block Island, 26 ne.; Newport, 25 n.; Provincetown, 28 ne.; Eastport, 37 ne.

#### NORTH ATLANTIC STORMS DURING NOVEMBER, 1882.

On chart SUPPLEMENTAL TO i. will be found the tracks of the principal storms that have prevailed over the north Atlantic ocean during November, 1882. The tracings of the paths of the centres of barometric minima are based on reports of observations received from agents and captains of ocean steamships and sailing vessels in the north Atlantic during the month, and from other miscellaneous data on file at this office up to December 25th.

The observations used are, in general, simultaneous, being taken each day at 7h. 0m., a. m., Washington, or 12h. 8m., p. m., Greenwich mean time.

The following brief notes concern the storms above mentioned:

I.—On the 1st, an area of low-pressure occupied the ocean between N. 45° and 55°, and between W. 25° and 35°. The lowest reported pressure was observed in N. 50° 08', W. 27° 13'; the s. s. "Scythia," reporting barometer 29.19 (741.4 mm.), wind w., force 7; rough sea and showery weather. By the morning of the 2d, the region of lowest pressure had apparently moved towards the British coasts; on that date, the s. s. "Celtic," in N. 51° 31', W. 13° 52', reported barometer 29.25 (742.9 mm.), wind w., force 8; squally and showery weather, with heavy sea. The barometer remained low near the British coasts, and strong westerly and southwesterly winds prevailed until the 4th.

II.—On the 2d, an area of low-pressure, probably subsidiary to low area i., appeared over mid-ocean, causing strong westerly gales and showery weather. On the 3d, the region of lowest pressure was near N. 54°, W. 28°. The s. s. "Anchoria," in N. 52° 58', W. 28° 10', reported barometer 29.30 (744.2 mm.), wind wsw., force 9; squally weather and heavy sea.

III.—On the 7th, a deep depression appeared near N. 55°, W. 20°. It apparently moved eastward, causing a decrease in pressure over that part of the ocean east of the fifteenth meridian. The s. s. "Bolivia," in N. 55° 02', W. 19° 27', reported barometer 28.85 (732.8 mm.), wind nw. force 8; rainy. On the 8th, the depression was probably near the north-western coast of Ireland; the s. s. "Arizona," in N. 51° 27' W. 14° 05', reported barometer 29.32 (744.7 mm.), wind wsw. force 7; squally weather and lightning, and the s. s. "Stella," in N. 50° 59', W. 14° 19', barometer 29.21 (741.9 mm.), wind wsw. force 9; squally.

IV.—A well-defined depression appeared on the 10th, with its centre to the westward of the Azores. The s. s. "Madrid," in N. 38° 54', W. 25° 31', reported barometer, 29.70 (754.4 mm.), being a fall of .38 inch in twenty-four hours; wind s. to sw. force 6; very heavy rain. On the 11th, the disturbance moved eastward and was probably central northeast of the Azores; the s. s. "Madrid" reported as follows: 11th, in N. 39° 19', W. 27° 16', at 7 a. m. wind w. force 7, lasted till 4 p. m., lowest barometer reading 29.62 (752.1 mm.). At 6 p. m. the wind shifted to wnw. and nw. and gradually decreased in force, while the barometer began to rise. At the same day, the s. s. "Peconic," in N. 36° 35', W. 18° 00', had s. wind of force 7; barometer falling and weather threatening. On the 12th, the same vessel, in N. 36° 50' W. 22° 00', reported barometer 29.74 (755.4), wind w. force 6; long cross sea.

V.—The reports indicate that a disturbance was present on the 13th near N. 50°, and between W. 30° and 40°. The s. s. "Stella," in N. 50° 36', W. 32° 40', reported barometer 29.62 (752.3 mm.), wind nw., force 5, squally. On the 14th, the s. s. "Wyoming," in N. 51° 22', W. 25° 11', had moderate winds, increasing to strong w. and sw. gale, with head sea. On the 15th, the depression moved northeastward, and was central near N. 55°, W. 14°; on that date, the s. s. "Scandinavian," in N. 54° 40', W. 16° 12', reported: 1.17 a. m. (Greenwich mean time), wind shifted to nw., with showery weather; at 8.49 a. m., barometer 29.48 (748.8 mm.), oscillating till noon; at 0.50 p. m., wind unsteady in direction and force; squalls moderating, but coming in quick succession, with hail and rain, sea very confused. This storm was probably identical with that which prevailed on the British coasts on the 16th.

VI.—This is a continuation of the storm traced as low area iii. on chart i. for November. On the 23d, the disturbance was central near the entrance to the Gulf of Saint Lawrence. It apparently moved northeastward, and on the 24th, was shown near N. 50°, W. 50°; the s. s. "Polynesian," in N. 48° 39', W. 47° 41', reported barometer 29.16 (740.7 mm.), wind sw., force 5, overcast, rough sea. On the 25th, the storm-centre, having moved slowly eastward, was apparently near N. 50°, W. 40°. During the 26th and 27th, the disturbance appears to have moved very slowly and was central in mid-ocean; on the last-mentioned date, the depression disappeared; probably yielding to the influence of an area of high barometer that prevailed on the 27th, 28th, and 29th, over the Atlantic east of the thirtieth meridian.

VII.—This is a continuation of low area iv of chart i. The depression was central in the Gulf of Saint Lawrence on the 26th; it moved over Newfoundland and disappeared to the northeastward on the following day.

#### INTERNATIONAL METEOROLOGY.

International charts iv. and v. accompany the present number of this REVIEW. Chart iv. is published for September, 1880, and continues the series of that chart began in January, 1877. Chart v. is prepared for November, 1880, and continues the series of that chart began in November, 1877. For the description of these charts, much valuable information has been obtained from the "Monatliche Uebersicht der Witterung," published by Professor Dr. G. Neumayer, Director of the German Marine Observatory at Hamburg, and from the "Bulletin Mensuel," published by Mr. Marc Dechrevels, of Zi-Ka-Wei, China.

Chart iv. exhibits the mean pressure, mean temperature, and the prevailing direction of the wind over the northern hemisphere, and at certain isolated stations in the southern hemisphere, as determined from one observation taken each day at 7.35 a. m. Washington, or 0.43 p. m. Greenwich mean time.

Two areas of barometric minima are shown on the chart. The first area, enclosed by the isobar of 29.70 (754.4), occupies British India; the second area, 29.80 (756.9), covers the extreme northwestern part of Norway, and, extending westward, includes Iceland within its limits.

The isobar of 29.90 (759.4) occupies Norway, Scotland, the northwest of Ireland, and the northern part of British America.

In the United States, the area of highest pressures occupies the south Atlantic and Gulf states, and the southern parts of Tennessee and Virginia.

On the Pacific coast, the area of barometric maxima occupies Oregon and Washington territory, the highest monthly mean, 30.23 (767.8), being reported from Umatilla, Oregon.

Compared with the preceding month, (August, 1880), the mean atmospheric pressure, in the United States, has increased over the country lying between the Atlantic ocean and the ninetieth meridian, and between 30° and 40° north latitude. It has also increased slightly on the Pacific coast. In all other parts of the United States, the mean pressure has remained unchanged. In Canada, the mean pressure has decreased slightly.

In Europe, the pressure has decreased over the British Isles; the Scandinavian peninsula, and over Denmark. In all other



parts of the continent, including Russia, there has been an increase of pressure.

In Greenland, the pressure has increased; the mean for the month, at Godthaab, being 29.82 (757.4), or .24 inch above that of August.

In Morocco, Algeria, and Tunis, the pressure has increased .10 inch.

In Asia, a general increase of pressure is shown over the entire continent.

Compared with the corresponding month of previous years, the mean barometric pressure is slightly above the normal in the Carolinas, and in Georgia. In the New England states and in Minnesota and Dakota, the pressure is slightly below the normal, and in all other parts of the United States it is about normal.

In Canada, the mean pressure is slightly below the normal.

The following table shows the mean pressure and mean temperature, with corresponding departures, for the month of September, 1880, in the several countries of Europe and Asia, compared with the means as determined from observations taken during the years 1877, 1878, and 1879:

Countries.	Mean Pressure.			Mean Temperature.		
	Sept., 1877, 1878, and 1879.	Sept., 1880.	Departure.	Sept., 1877, 1878, and 1879.	Sept., 1880.	Departure.
Algeria.....	30.01	30.08	+0.07	80.8	83.4	+2.6
Austria.....	29.96	30.01	+0.05	66.2	67.0	+0.8
British Isles.....	29.98	29.96	-0.02	58.6	53.0	-4.6
Denmark.....	29.89	29.95	+0.06	58.0	62.5	+4.5
France.....	30.02	30.03	+0.01	68.0	70.5	+2.5
Germany.....	30.00	30.03	+0.03	62.9	67.3	+4.4
India.....	29.69	29.71	+0.02	82.9	81.2	-1.7
Italy.....	29.96	30.03	+0.07	75.9	74.2	-1.7
Norway.....	29.76	29.86	+0.10	54.7	59.7	+5.0
Portugal.....	30.00	30.07	+0.07	73.5	78.7	+5.2
Russia.....	29.93	30.01	+0.08	61.8	63.8	+2.0
Spain.....	30.02*	30.06	+0.04	75.0*	76.9	+1.9
Sweden.....	29.79	29.96	+0.17	55.1	59.0	+3.9

\* Mean for two years only.

The accompanying table shows the deviations in pressure and temperature at isolated stations during the month of August, 1880, as compared with the means of three years:

Comparative Thermometric and Barometric Means, with corresponding Departures.

STATION.	Mean Pressure.			Mean Temperature.		
	Sept., 1877-79.	Sept., 1880.	Departure.	Sept., 1877-79.	Sept., 1880.	Departure.
San José, Costa Rica, C. A.....				87.8	87.8	normal
Hibraltar.....	29.99	30.05	+0.06	75.4	76.9	+1.5
Malta, Mediterranean Sea.....	29.93	30.00	+0.07	82.9	81.0	-1.9
Sandwich Manse, Orkney Islands.....	29.83	29.85	+0.02	53.5	56.8	+3.3
Bridgetown, Barbadoes.....	29.93	29.99	+0.06	83.1	80.9	-2.2
Cape Town, Cape Good Hope.....	30.14	30.10	-0.04	64.6	65.1	+0.5
Fort Napier, Natal, South Africa.....	29.96	29.93	-0.03	73.8	75.0	+1.2
Freetown, Sierra Leone.....	29.89	29.88	-0.01	81.7	83.2	+1.5
Mauritius, Indian Ocean.....	30.15	30.18	+0.03	73.3	72.2	-1.1
Melbourne, New South Wales.....	30.03	30.02	-0.01	52.7	52.6	-0.1
Nassau, Bahamas.....	29.97	30.01	+0.04	83.5	82.0	-1.5
Godthaab, Greenland.....	29.72	29.82	+0.10	38.0	39.0	+1.0
Stykkisholm, Iceland.....	29.60	29.68	+0.08	44.8	45.7	+0.9
Thorshavn, Faroe Islands.....	29.72	29.74	+0.02	50.5	53.8	+3.3
Fort-de-France, Martinique.....	29.89	30.17	+0.28	81.1	77.2	-3.9
Zi-Ka-Wei, China.....	29.93	29.96	+0.03	70.2	71.4	+1.2
Athens, Greece.....	29.95	29.98	+0.03	83.1	79.2	-3.9
Lahore, British India.....	29.63	29.64	+0.01	91.4	93.1	+1.7
Cagliari, Sardinia, Italy.....	29.94	29.97	+0.03	79.2	79.3	+0.1
Tokel, Japan.....	29.91	30.01	+0.10	69.7	73.4	+3.7
Tromsø, Norway.....	29.62	29.79	+0.17	47.9	48.9	+1.0
Angra, Azores.....	30.18	30.18	normal	70.3	72.0	+1.7
Punchal, Madeira Islands.....	30.10	30.14	+0.04	75.7	76.6	+0.9
Ponta Delgado, Azores.....	30.20	30.17	-0.03	73.0	73.4	+0.4
Archangel, Russia.....	29.80	30.00	+0.20	49.6	54.4	+4.8
Tiflis, Russia.....	29.93	29.96	+0.03	76.4	73.4	-3.0
Astrakhan, Russia.....	30.01	30.04	+0.03	70.4	68.9	-1.5
Ekaterrinburg, Russia.....	29.89	30.07	+0.18	52.2	57.9	+5.7
Nukuss, Toorkistan, Asia.....	29.98	30.02	+0.04	75.5	75.0	-0.5
Tashkend, Toorkistan, Asia.....	30.00	29.94	-0.06	68.9	70.3	+1.4
Barnaul, Siberia, Asia.....	29.89	30.03	+0.14	57.9	50.9	-7.0
Pekin, China.....	29.96	30.00	+0.04	68.2	65.5	-2.7
Nikolaievsk on the Amoor, Asia.....				49.6	50.7	+1.1
San Juan de Puerto Rico, W. I.....	29.94	30.04	+0.10	81.3	82.0	+0.7
Beirut, Turkey in Asia.....	29.85	29.89	+0.04	85.1	83.8	-1.3
Havana, Cuba, W. I.....	29.95	30.04	+0.09	81.8	80.1	-1.7
Paramaribo, D. Guiana, S. A.....	30.06	29.98	-0.08	82.9	80.5	-2.4
York Factory, B. A.....	29.92	29.99	+0.07	36.6	38.0	+1.4

\* Means for two years only.

In the United States, north of the forty-third parallel of latitude, the temperature was normal, or slightly above; in Virginia, Maryland, Pennsylvania, and New York, the temperature was above the normal; in other sections of the country it was below the normal. In Canada, the mean temperature was slightly above the normal.

In Europe, the mean temperature of the air was everywhere above the normal, the greatest excesses occurring in the northern and northwestern part of the continent.

In British India, the temperature was slightly below the normal; the highest mean, 93° 1 Fahr. (33° 9 Cent.), was reported at Lahore, and the lowest, 68° 8 Fahr. (20° 4 Cent.), at Belgaum.

The following are some of the extreme monthly mean temperatures reported at isolated stations:

HIGHEST.	Degrees.	LOWEST.	Degrees.
Beirut, Asia.....	83.8	York Factory, British America...	36.0
Freetown, Africa.....	83.2	Godthaab, Greenland.....	39.0
Saint Thomas, West Indies.....	82.6	Yeniseisk, northwestern Siberia..	40.8
Nassau, Bahamas.....	82.0	Nertchinsk, southeastern Siberia..	44.8

In the United States, the prevailing directions of the wind were: east of the Mississippi river and north of the fortieth parallel, southerly; along the immediate Atlantic coast, northerly and northeasterly; in Georgia, Alabama, and Mississippi, northerly and northwesterly; in Texas, southerly and southeasterly.

In Canada, the winds were westerly and southwesterly.

In Europe, the prevailing directions of the wind were as follows: westerly and southwesterly in the British Isles, Denmark, and central Germany; southerly and southwesterly in France; in Russia, they were mostly southerly.

In Algeria, Morocco, and Tunis, the winds were variable.

In Asia, the prevailing directions were westerly and southwesterly; at Zi-Ka-Wei, China, it was easterly; at stations in the island of Nippon, the winds were southerly; at other stations in Japan, they were northerly and northeasterly.

Over the Atlantic ocean, the prevailing winds were: southwesterly off the coasts of the United States, in the Bay of Biscay, and off the British coasts; north of the forty-fifth parallel, they were northerly and northwesterly.

The rainfall of the month was above the average in Texas, Arkansas, Mississippi, Alabama, and Tennessee; it was about the average in the New England states and in the interior of the country, elsewhere it was below the average.

In Canada, the rainfall was everywhere above the average.

In central and northwestern Europe, the rainfall was generally above the average.

Chart v. exhibits the paths of barometric depressions which have been traced from the daily international charts for the month of December, 1880.

The data are charted for each day of the month, on the charts accompanying the "INTERNATIONAL BULLETIN" for that day, and from these charts and from additional reports, are traced the movements of the centres of barometric minima.

Thirty-six of the principal storms that have occurred over the northern hemisphere have thus been traced. The following concerns the general distribution of these depressions:

Sixteen appeared in the United States and Canada; five of which, after leaving the coast of North America, crossed the Atlantic ocean, and appeared in Europe. An unusually large number of depressions appeared on the Pacific coast; of these, four have been traced across the country to the Atlantic.

Fifteen areas of low barometer appeared in Europe; of these, thirteen traversed the northern and western parts of the continent, while two depressions,—numbers xxxiii. and xxiii.—appeared south of the forty-fifth parallel. North of the sixtieth parallel of latitude, the general direction of the storm-centres was from northwest to east-southeast, south of the above-mentioned latitude, the movement was towards the northeast or east-northeast.

Five depressions are traced in Asia; four of these appeared

in Japan, and one,—number xxxii.—occurred in Asiatic Turkey.

The following brief descriptions of the storms which first appeared in North America, are given:

I.—This depression was a continuation of low-area x. of the November chart. On the 1st, the disturbance was central near N. 51°, W. 42°; the s. s. "Germanic," in N. 48° 23', W. 42° 50', reporting barometer 29.60 (751.8), wind w., force 6, and the s. s. "Circassian," in N. 52°, W. 34°, encountered a strong s. gale, with hard squalls. On the 2d, the depression disappeared southeast of Greenland.

II.—This area was a continuation of the storm given as low-area xi. on the November chart. The depression was central near Lake Erie on the 1st; moving rapidly eastward, it passed into the Atlantic, and on the 2d, was central, with greatly decreased pressure, south of Newfoundland. On that day, the s. s. "Köln," in N. 41° 43', W. 50° 44', reported barometer 28.67 (728.2), wind wsw., force 4-5, heavy sea; ship "Nairnshire," in N. 41° 25', W. 43° 29', barometer 29.14 (740.1), wind sse., force 8, raining. On the 3d, a large area of low barometer occupied mid-ocean, the region of lowest pressure being near N. 50°, W. 40°; the s. s. "Illinois," in N. 49° 39', W. 37° 20', reported barometer 28.68 (728.5), wind sw., force 7, squally, while strong gales with rainy weather prevailed over the ocean between W. 60° and W. 30°. On the 4th, the depression, having moved very slowly in a northerly direction, was central near N. 55°, W. 35°, the s. s. "Republic," in N. 50°, W. 32°, reporting strong s. gale, veering to w., and the s. s. "France," in N. 47°, W. 37°, encountered hurricane-like winds from se., sw., and nw. On the 5th, the storm-centre was probably near N. 60°, W. 30°, and by the 6th, it had moved to the northward of Iceland, barometer at Stykkisholm reading 29.31 (744.8), wind sw., raining. On the 7th, the disturbance, moving in a northeasterly direction, was central at some distance off the coast of Norway. The subsequent course of this depression is given as low-area xix. of this chart.

III.—This disturbance was first observed off the coast of Oregon, where it prevailed as a somewhat severe storm for several days; the ship "Remijio," off Columbia river, reported heavy wsw. to nw. and sw. gales, from November 29th to December 3d. The storm-centre entered Oregon on the 2d, and caused strong gales along the California coast; on the 3d, the depression, having moved slowly east-southeastward, was central in Nevada, its passage being marked by heavy rains in that state and in California. By the morning of the 4th, the storm-centre was in Wyoming, whence it moved rapidly east-northeastward, and on the 5th, it appeared in northern Michigan, the pressure at Escanaba being 28.89 (733.8), or 1.13 inches below the normal. Owing to the presence of an area of high-pressure, 30.20 (767.1), which followed immediately in the rear of the depression, very high southwesterly and northwesterly winds prevailed on lakes Superior, Michigan, and Huron, where the maximum winds of the month occurred in connection with this area. On the 6th, the depression moved down the Saint Lawrence valley and was central near Father Point. During its passage, the barometric pressure had greatly increased and the storm lost much of its energy. It disappeared to the northward of the Gulf of Saint Lawrence on the 6th.

IV.—After the passage of low-area iii., the pressure decreased in North Carolina, and the circulation of the winds indicated the presence of a barometric disturbance near the coast. On the morning of the 7th, the disturbance appeared south of Nova Scotia as a well-defined area of low barometer. It moved northeastward and disappeared on the 8th to the northward of Newfoundland.

V.—This disturbance appeared in Nebraska on the morning of the 7th, and moved rapidly eastward to the lake region, where it was central near Georgian Bay on the 8th. Heavy snow-storms occurred in Ontario and in the state of New York during the passage of this area.

VI.—This storm developed near Bermuda, where a heavy

nw. gale, with violent squalls, occurred on the 10th. On the 11th, the storm-centre was near N. 38°, W. 62°, the s. s. "Arizona," in N. 43°, W. 61°, reporting strong e. to ne. gale, while the nw. gale still continued at Bermuda. On the 12th, the disturbance was central south of Newfoundland, the pressure at Saint John's, Newfoundland, being 29.40 (746.7), wind se. On the 13th, the storm-centre moved in a northeasterly course to N. 51°, W. 45°, the s. s. "Celtic," in N. 47° 16', W. 45° 42', reporting barometer 29.46 (749.3), wind wsw., force 7; on the same day, the s. s. "Suevia," in N. 43°, W. 54°, encountered a heavy ssw. to w. gale, with high sea, and the bark "Von Berg," off the Banks, had a violent e. to ene. gale, with blinding snow-storm. On the 14th, the depression, following an east-northeasterly course, was central near N. 45°, W. 30°, the s. s. "City of Chester," in N. 49°, W. 38°, reporting strong sw. to wnw. gale. On the 15th, the disturbance was off the British coasts, and is hereafter described as low area xxii., of this chart.

VII.—This low area developed apparently in Manitoba, British America, on the 10th, and by the 11th, was central in Minnesota. It moved, by a course slightly south of east, towards Lake Michigan, where it was central on the morning of the 12th. On the 13th, the centre of disturbance was in Ontario, where the lowest reported pressure was 29.44 (747.8), at Parry Sound. During the 13th, the storm moved northeastward over the Maritime Provinces, and disappeared on the 14th, in the Gulf of Saint Lawrence. No high winds occurred in connection with this depression, but it was attended by rain and snow in all the districts through which it passed.

VIII.—This disturbance developed in the Saskatchewan valley on the 12th, and, moving southeastward during the day, was central in Minnesota on the 13th. The depression continued its southeasterly movement, and by the morning of the 14th, was central over Lake Michigan; the course then changed to the east-northeastward, and the disturbance moved, with decreasing pressure at the centre, down the Saint Lawrence valley to the gulf, where it was central on the 16th. During the 17th, 18th, and 19th, the barometer remained low over the New England states and the Canadian Maritime Provinces, and the centre appears to have remained nearly stationary on those days, but on the 20th, it resumed its northeasterly movement and appeared near N. 50°, W. 40°. On that date, the s. s. "Pennsylvania," in N. 49° 23', W. 35° 33', reported barometer 29.23 (742.4), wind s., force 5. During the 20th, this disturbance probably united with low area x., and is subsequently described in connection with that depression.

IX.—This depression, which was of slight importance, appeared in Indian Territory on the 15th, and was probably an off-shoot of low area x., in which it merged on the following day.

X.—This disturbance developed over the Pacific ocean, and was central off the coast of British Columbia on the 14th, on which date heavy southwest gales occurred over Puget sound. The storm-centre moved in a southeasterly direction, and on the 15th, was central in Washington Territory, where the lowest reported pressure was 29.16 (740.7), or 1.02 inches below the normal, at Olympia. On the 16th, the disturbance was in western Colorado, with increased pressure at the centre; the course then changed to east-southeasterly, and the depression moved rapidly across the country and passed off the North Carolina coast into the Atlantic, on the 18th. Moving north-eastward, at some distance from the coast, this area, having united with the remains of low area viii., formed an extensive and deep depression south of Newfoundland. The disturbance remained nearly stationary during the 20th and 21st; on the latter date, the pressure decreased .50 inch, the s. s. "Pennsylvania," in N. 48° 08', W. 40° 22', reporting barometer 28.96 (735.6), wind s., force 5. On the 22d, the storm-centre was near N. 53°, W. 30°; the s. s. "Ethiopia," in N. 51° 01', W. 38° 43', reported barometer 29.00 (736.6), wind n., force 5, and the s. s. "Westphalia," in N. 49°, W. 27°, encountered a wsw. gale with heavy sea. On the 23d, the depression was central off



the coast of Scotland. This disturbance is hereafter described as low area xxix. of this REVIEW.

XI.—This storm developed in the Pacific ocean, and was first observed on the 15th by the ship "Ella" when about five hundred miles west of the Farallone islands. On that day, the vessel encountered strong sw. gale, with very heavy sea and squally weather, barometer falling to 29.95 (760.7); on the evening of the 15th, the wind shifted to wnw. and blew in strong gusts until the morning of the 16th, when it moderated. On the 17th, the wind increased in force from the se.; at 10.00 p. m. it began to lull, and veered to e., ne., n., and finally to nw., accompanied by very heavy sea. The lowest observed pressure was 29.55 (750.6), on the 17th. On the 15th, the ship "Fresno," in N. 35° 00', W. 126° 30', had strong nw. wind, and on the 17th, when off the Farallones, she encountered se. veering to ne. gales, in which she lost several sails. On the morning on the 18th, the depression was central in California, where it filled up during the day. Strong gales prevailed along the Californian coast during the presence of this disturbance.

XII.—This depression developed over the Gulf of Mexico on the 18th, and moved northeastward to northern Florida, where it was central on the 19th. On the morning of the 20th, the storm was central off the coast of North Carolina, the bark "Omega," in N. 35° 21', W. 74° 15', encountering a strong ene. gale, which lasted twenty-four hours. On the 21st, the depression, following the trend of the coast, was central off the New England coast; very severe northeasterly gales and heavy snow-falls occurred along the middle Atlantic coast during the passage of the disturbance. During the 21st, the barometric pressure decreased rapidly, and the storm-centre moved in an easterly direction over the Atlantic; on the 22d, it was near N. 40°, W. 55°, attended by strong southwest to northwest gales. On the 23d, the centre was in N. 45°, W. 42°; the lowest barometer, 29.20 (741.7) being reported by the s. s. "Illinois," in N. 44° 28', W. 44° 25'. On the 24th, the depression presented an elliptical form, and extended in a northeasterly direction from N. 38° to N. 52°, and from W. 52° to W. 35°. During the 25th and 26th, the storm-centre moved toward the British coasts, and on the last-mentioned date was near N. 50°, W. 20°. A decrease of pressure set in over the British Isles on the 26th, and the winds shifted to south and southeast. This area is hereafter designated as low area xxx.

XIII.—This depression appeared off the Pacific coast on the 22d, the s. s. "Belgie," in N. 38° 01', W. 124° 54', reporting barometer 29.73 (755.1), wind s., force 5, raining. During the 23d and 24th, the centre passed rapidly southeastward, and was in Georgia on the morning of the 25th; the pressure decreased rapidly during the day, and the disturbance moved northeastward to the coast of North Carolina, where it was central on the 26th. The storm-centre then moved northeastward very near to the coast, and in a line parallel to it; on the 28th, it passed over Cape Breton Island, causing heavy snow in the Maritime Provinces, and finally disappeared north of Newfoundland. During its passage along the Atlantic coast, this storm exhibited great energy, causing very heavy ne. to nw. gales, with rain and heavy snowfalls.

XIV.—This depression moved southeastward from Manitoba, crossed Lake Superior, and on the 27th was central in Ontario. During the day, it moved eastward over the Maritime Provinces, and merged, on the 28th, with the preceding depression, low area xiii.

XV.—This disturbance appeared off the coast of Oregon on the 27th. The centre pursued a southeasterly course, and, on the morning of the 28th, was in western Texas, whence it moved over the Gulf of Mexico; the course then changed to northeasterly, and the centre crossed northern Florida on the 29th. The centre of disturbance then moved northeastward nearly parallel with the coast, its track being similar to, but farther to the eastward than, that of low area xiii. On the night of the 29th, the depression passed as a severe storm over the Canadian Maritime Provinces, and on the 30th it was central over

the Gulf of Saint Lawrence. By the 31st, it had moved north-northeastward, and was probably merged in a deep depression which appeared over Greenland at the close of the month.

XVI.—This depression moved from the northwest territories of British America, in a southeasterly direction, toward Lake Superior, near which it was central on the 29th. It passed over Canada, and united with low-area xv., over the Gulf of Saint Lawrence, on the 30th.

The following descriptions concern the storms that occurred in Europe during December, 1880.

XVII.—This depression appeared off the southwestern coast of Norway, on the morning of the 1st, causing rainy weather over the southern part of the Scandinavian peninsula and over Scotland. During the 1st, the depression moved eastward and on the morning of the 2d, it was central near the eastern shores of the Baltic. Strong southwesterly winds prevailed over the Baltic sea, and rain fell at stations in advance of the centre; after the passage of the disturbance, the pressure increased rapidly over Scandinavia and the British Isles, and was accompanied by a considerable fall in temperature. On the 3d, the depression, continuing its easterly movement, was central near Moscow, and on the 4th, it probably merged in an extensive area of low-pressure, which, on that date, occupied northeastern and central Russia.

XVIII.—An area of low, but slowly increasing pressure occupied northeastern and central Russia, and western Siberia from the 1st to the 5th. During its prevalence, the temperature fluctuated irregularly in the districts above-named, until the 6th, when a fall became general, and an area of high-pressure began to spread over European Russia and western Asia.

XIX.—This is a continuation of the storm traced from the American continent, as low-area ii. On the morning of the 8th, the disturbance was central off the northern coast of Norway; rain fell at stations in Scandinavia and over the northern part of Scotland, and a rise in temperature occurred over the same districts. On the 9th, the region of lowest pressure remained in northern Scandinavia, while a decided barometric fall took place over Russia and over western Siberia, on that day.

XX.—This depression appeared to the westward of Greenland on the 9th. On that date, the barometer at Godthaab read 29.08 (736.6), being a fall of .52 inch in twenty-four hours. The centre moved over the southern extremity of Greenland, where it was central on the following day. On the 11th, the storm-centre passed eastward, south of Iceland, and was near the Færoe islands, causing a decided fall in pressure, with strong westerly and southwesterly winds and rain over the northern part of the British Isles. By the morning of the 12th, the disturbance was central in southern Scandinavia, the lowest reported pressure being 28.92 (734.6), at Stockholm. Strong westerly winds prevailed at stations in the southern quadrants, and cloudy weather with rain or snow, was general throughout central and northern Europe. On the 12th, the storm-centre moved by a southeasterly course over the Baltic and entered Russia. Very heavy southwest to northwest storms occurred in northern Germany during the passage of this depression; the river Elbe rose ten feet above its normal level, and caused much damage to vessels and other property. At Kiel, in the duchy of Holstein; Glückstadt, Hanover; and at Hamburg, houses were unroofed and chimneys blown down, and a large number of trees were uprooted. On the morning of the 13th, the centre of disturbance was near Vilna, in the province of West Russia, at which station, the barometer read 29.19 (741.5). On the 13th and 14th, a trough of low-pressure extended from the Baltic provinces, eastward to central Russia. By the morning of the 15th, the storm-centre, having moved southeastward, was near Lugan, South Russia, barometer 29.12 (739.6), wind wsw. During the day, the disturbance probably moved northeastward, and disappeared in the vicinity of the Ural mountains. Under the influence of this depression, strong westerly winds occurred over the Black sea.

XXI.—This depression appeared near the Norwegian coast on the 11th, and probably developed from the remains of low area xx. It pursued a southeasterly course; crossed the Baltic, and was central in the Baltic provinces of Russia on the 11th. It apparently filled up on the 12th, in eastern Russia.

XXII.—This is a continuation of the storm described as low area vi. On the morning of the 15th, the disturbance was central off the west coast of Ireland; it passed eastward over the British Isles and the North sea during the day, and on the 16th, was central in northern Germany. It moved rapidly eastward, with increasing pressure at the centre, and disappeared in eastern Russia on the 17th.

XXIII.—This depression appeared in northern Italy on the 15th. It crossed the Adriatic sea and disappeared in Austro-Hungary on the 16th. This disturbance was very slight, the pressure at no time falling below 29.80 (756.9).

XXIV.—This depression appeared in northern France on the 17th, and was attended by rain and by a slight rise in temperature over that district and over the southern part of England and the channel. On the 16th, the disturbance moved northeastward into Germany, where it ceased to exist as a depression.

XXV.—This disturbance, enclosed by the isobar of 29.20 (741.7), was central on the morning of the 17th in the extreme northern part of Scandinavia. It moved in a course slightly south of east, toward the White sea, where it was central on the 18th. The course then changed to northeasterly, and the depression disappeared on the 19th, east of Archangel.

XXVI.—During the night of the 17th-18th, a very sudden and marked change occurred in the distribution of pressure over the British Isles. On the morning of the 18th, a deep depression, enclosed by the isobar of 28.80 (731.5), appeared north of Ireland, causing a barometric fall of .75 to 1.00 inch over the British Isles, the North sea, and over the western part of Germany. Rain fell in Ireland and in the northwestern part of Scotland, and the temperature rose several degrees as the depression moved eastward. By the morning of the 19th, the centre of disturbance, which appeared to move slowly, was over the northern part of the North sea, with the pressure gradually decreasing as the disturbance moved eastward. Strong westerly and southwesterly gales prevailed at nearly all stations in Ireland and Scotland, and at scattering stations in England. Comparatively high pressures, 29.80 (756.9), occupied Scandinavia and northern France; where the winds were easterly and southwesterly, respectively. The pressure rose rapidly over the British Isles, after the passage of the disturbance, while a slight decrease set in over northern France, and generally heavy rains occurred over that section. By the morning of the 20th, low area xxvi had moved, by a course slightly north of east, to southern Scandinavia. The temperature rose several degrees and snow fell in that region during the day, while fresh to strong westerly and southwesterly winds were reported from Denmark and Germany. On the 21st, the storm moved over the Baltic by a southeast course and disappeared in the Baltic provinces on the same day.

XXVII.—On the 20th, a decrease of pressure set in over northern France; the disturbance moved in a southeasterly direction, and by the morning of the 21st, it was central in northern Italy. During its passage, rain fell at stations in Switzerland and in Hungary. On the 22d, the storm-centre was in European Turkey, attended by light rains there and in Greece; during the day, the disturbance moved eastward and disappeared over the Black Sea.

XXVIII.—This depression appeared off the northern coast of Norway on the 21st, and moved, by a southeasterly course, across the peninsula. On the 22d, it was central over the Gulf of Bothnia, and, on the following day, it disappeared in Finland. During the passage of this depression, rain or snow, and slightly lower temperatures prevailed over the northern part of Scandinavia.

XXIX.—This is a continuation of the storms traced as low areas viii. and x. of this chart. On the 23d, the depression

was central to the northwest of Ireland, the area of lowest pressure being enclosed by the isobar 29.20 (741.7); while a secondary depression existed over the North sea. Under the influence of these disturbances, heavy rains fell at nearly all stations in the British Isles, and on the eastern shores of the North sea, and brisk southwesterly winds prevailed over those districts. On the 24th, the disturbance was central over the North sea, the lowest pressure being reported at Fano, Jutland, where the barometer read 28.99 (736.3), wind s., force 4. The depression moved slowly northeastward, and on the 25th, was central off the southwestern coast of Sweden. On the 26th, it continued its northeasterly course and was central at the entrance to the Gulf of Bothnia. Rain and snow fell at stations north and east of the centre, but no decided change occurred in temperature. On the 27th, the disturbance was in Finland, where it finally disappeared.

XXX.—This is a continuation of low area xii., which originated over the Gulf of Mexico on the 18th. On the 27th, the disturbance was central near N. 50°, W. 15°; the s. s. "Scythia," in N. 51° 01', W. 15° 23', reporting barometer 29.12 (739.6), wind nne., force 6, raining, and the bark "Gem," in N. 48° 55', W. 12° 55', barometer 29.24 (742.7), wind wsw., force 5. During the 27th, the depression crossed England and moved toward the North sea, where it was central on the 28th. After the passage of the centre, the pressure still remained low over the British Isles, under the influence of low area xxxi., which had advanced from the southwest, during the night of the 28th.

XXXI.—This disturbance was central near the Bristol Channel on the morning of the 29th. The temperature rose at stations in the southern part of England and in northern France, and rain was general throughout the British Isles, except in the northern parts of Scotland and Ireland. The depression moved northeastward over the North sea, and by the 30th, it was central in southern Scandinavia. The heavy rain which fell during the passage of the disturbance, caused some damage by floods, at various places in England. On the 31st, the depression continued its northeasterly course and at close of the month, it was central in northern Sweden.

Of the storms appearing over Asia, the following are given:

XXXII.—This depression appeared on the 7th near Beirut, Syria. On that day, the barometer showed a fall of .15 inch, and the wind shifted from southeast to southwest. The disturbance probably moved northeastward and crossed the Caspian sea, as on the 29th, the depression was well-defined near Nukuss, Toorkistan. On the following day the disturbance disappeared.

XXXIII.—The disturbance passed over the island of Nippon on the 8th, on which date it was central near Tokei. The depression moved slowly northeastward, with decreasing pressure at the centre, and on the 9th, was central probably near N. 40°, E. 148°. The s. s. "City of Pekin," in N. 37° 19', E. 147° 13', reported barometer 29.13 (739.9), wind wnw., force 6, squally. On the 10th, the centre was near N. 41°, E. 153°, the area of lowest pressure being enclosed by the isobar of 29.00 (736.6); during the 11th, 12th and 13th, the depression moved apparently in a northeasterly direction, and disappeared on the last-mentioned date, near the Aleutian Islands. The track of the depression has been approximately located from reports of observations taken on board the s. s. "City of Pekin," which vessel was evidently under the influence of the disturbance from the 11th to the 13th.

XXXIV.—This disturbance appeared near Nikolaievsk, on the Amoor, on the 14th, and disappeared over the sea of Okhotsk on the 15th.

XXXV.—This was an area of relatively low-pressure which, from the 19th to the 23d, occupied the eastern coasts of Japan. During its presence, cloudy or partly cloudy and rainy weather prevailed along the coasts.

XXXVI.—This storm developed over the island of Nippon on the 27th. On that date, the barometer at Tokio, read 29.85 (758.3), showing a fall of .34 inch. On the 28th, the storm



moved into the Pacific, and was central near N. 37°, E. 154°, the s. s. "City of Tokio," in N. 32° 22', E. 145° 07', reporting barometer 29.88 (758.9), wind nw, force 7, cloudy. The following reports from the s. s. "Gaelic" indicate the presence of this depression in the Pacific ocean. On the 29th, in N. 44° 15', E. 167° 05', barometer 29.06 (738.1), wind wsw., force 5, clear; 30th, in N. 44° 32', E. 173° 04', barometer 28.96 (735.6), wind nw., force 5, raining; 31st, in N. 44° 47', E. 179° 59', barometer 28.87 (733.3), wind w., showery.

As a noteworthy feature in the atmospheric conditions over eastern Asia, may be mentioned the high pressures 30.20 (767.1) to 30.60 (777.2) that prevailed over the Chinese Empire from the interior to the coast, while areas of relatively low-pressure prevailed over Japan. Unusually low temperatures occurred in China; at Zi-Ka-Wei, near Shanghai, the minimum temperature of the month, 21.2° Fahr., (—6° 0 Cent.), occurred on the 28th.

### TEMPERATURE OF THE AIR.

The distribution of mean temperature, over the United States and Canada, for the month of November, 1882, is exhibited on chart ii., by the dotted isothermal lines. The table of comparative mean temperatures in the lower left-hand corner of the

chart, shows the average temperature for the month in the several districts, as determined from observations taken at the Signal Service stations during the month of November in previous years.

Along the Atlantic coast, from New England to Florida, the mean temperature of the month is below the normal. In Florida, the departure is 2°.2; in the south Atlantic states, 1°.9, and in New England and the middle Atlantic states, less than 1°. In the northern and middle plateau districts, and on the Pacific coast, the temperature is also below the normal, the most marked departures occurring in the northern plateau and middle Pacific coast region, where they are 4°.4 and 3°.3, respectively. Throughout the remainder of the country the mean temperature is above the normal, the greatest departures occurring in the upper lake region, extreme north-west, the upper Mississippi and Missouri valleys, where the range is from 3°.7 to 4°.6. From the lower lake region south-westward to the Rio Grande valley, the departures vary from 1°.4 in the lower lake region, to 2°.8 in the Rio Grande valley.

### DEVIATIONS FROM MEAN TEMPERATURE.

Under this heading, departures exhibited by the reports, from the regular Signal Service stations, are shown in the table of

Table of Comparative Minimum Temperatures for the Month of November.

State or Territory.	Minimum for November, 1882, Signal Service.		Lowest since Signal Service stations were opened—3 to 11 years.			Lowest from any other source.			
	Station.	Temp.	Station.	Temp.	Year.	Place.	Temp.	Year.	Length of Record.
Alabama	Montgomery	0	Montgomery	0	1881	Huntsville	0	13	9 years.
Arizona	Fort Apache	13	Prescott	-1	1881	Whipple Barracks	-1	16	9 "
Arkansas	Fort Smith	22	Little Rock	10	1880	Fort Smith	6	21	21 "
California	Red Bluff	29	Campo	16	1881	Fort Bidwell	9	11	11 "
Do						Summit	1		
Colorado	Pike's Peak	-26	Pike's Peak	-36	1880	Fort Garland	-35	30	30 "
Do	West Las Animas	-1							
Connecticut	New Haven	16	New Haven	2	1875	New Haven	2	87	87 "
Dakota	Fort Buford	-3	Pembina	-40	1874	Fort Buford	-37	16	16 "
Delaware	Delaware Breakwater	29	Delaware Breakwater	23	1880	Delaware City	13	4	4 "
Dist. of Columbia	Washington	24	Washington	12	1880	Washington	12	49	49 "
Florida	Pensacola	30	Saint Marks	27	1877	Fort Barrancas	19	59	59 "
Georgia	Atlanta	29	Atlanta	20	1881	Atlanta	10	7	7 "
Idaho	Eagle Rock	-14	Eagle Rock	-1	1881	Fort Hall	-12	4	4 "
Illinois	Champaign	15	Champaign	-3	1880	Augusta	-12	19	19 "
Indiana	Indianapolis	22	Indianapolis	5	1880	Indianapolis	4	18	18 "
Indian Territory	Fort Supply	9	Fort Gibson	-10	1880	Fort Gibson	0	52	52 "
Iowa	Davenport	13	Dubuque	-9	1875	Independence	-17	18	18 "
Kansas	Dodge City	7	Dodge City	-7	1880	Fort Leavenworth	-14	51	51 "
Kentucky	Louisville	29	Louisville	8	1880	Newport Barracks	-23	30	30 "
Louisiana	Shreveport	29	Shreveport	18	1880	Fort Jessup	17	23	23 "
Maine	Eastport	20	Eastport	-13	1875	Orono	-16	13	13 "
Do						Brunswick	-3	23	23 "
Maryland	Baltimore	26	Baltimore	15	1880	Emmitsburg	7	12	12 "
Massachusetts	Springfield	16	Boston	-2	1875	Florida	-14	4	4 "
Michigan	Port Huron	10	Marquette and Escanaba	-9	'79-'80	Fort Brady	-17	59	59 "
Minnesota	Moorhead	-7	Duluth	-29	1875	Fort Ripley	-30	17	17 "
Mississippi	Starkville	29	Vicksburg	23	'77 & '80	Columbus	22	10	10 "
Missouri	Springfield	20	Saint Louis	8	1880	North Springfield	-9	1	1 "
Do						Allentown	-5	4	4 "
Do						Jefferson Barracks	-2	35	35 "
Montana	Terry's Landing	-15	Fort Benton	-31	1875	Camp Baker	-42	9	9 "
Nebraska	North Platte	5	Fort Platte	-10	1877	Camp Sheridan	-17	6	6 "
Nevada	Pioche	6	Winnemucca	-9	1880	Camp Halleck	-12	11	11 "
New Hampshire	Mount Washington	-7	Mount Washington	-40	1877	Grafton	-16	2	2 "
Do						Dartmouth College	-9	18	18 "
New Jersey	Atlantic City	21	Atlantic City	10	1875	North Germantown	6	2	2 "
Do						Newark	8	38	38 "
New Mexico	Santa Fe	6	Santa Fe	-11	1880	Fort Union	-15	31	31 "
New York	Buffalo	17	Albany	-10	1875	Canton	-20	2	2 "
Do	Rochester	17				Gouverneur	-17	40	40 "
North Carolina	Charlotte	28	Charlotte	18	1880	Fort Johnston	9	54	54 "
Ohio	Sandusky	19	Columbus	-5	1880	Westville	-13	9	9 "
Do						College Hill	-2	68	68 "
Oregon	Umatilla	15	Umatilla	9	1880	Camp Harney	4	12	12 "
Do						Fort Dalles	4	16	16 "
Pennsylvania	Williamsport	14	Pittsburg	4	1880	Franklin	-8	8	8 "
Do						Philadelphia	12	113	113 "
Rhode Island	Point Judith	15	Newport	4	1875	Alleghany Arsenal	4	31	31 "
Do	Narragansett Pier	15	Charleston	28	1881	Fort Adams	3	41	41 "
South Carolina	Charleston	36							
Tennessee	Knoxville	27	Knoxville	15	'80 & '81	Aiken	23	8	8 "
Texas	Fort Elliott	14	Fort Elliott	-5	1880	Charleston	28	105	105 "
Do						Clarksville	-3	8	8 "
Utah	Salt Lake City	7	Salt Lake City	3	1880	Fort Elliott	-8	3	3 "
Vermont	Burlington	17	Burlington	-10	1875	Fort Richardson	8	10	10 "
Virginia	Lynchburg	27	Lynchburg	13	1880	Coalville	-18	9	9 "
Do						Newport	-18	9	9 "
Washington	Colfax	10	Spokane Falls	3	1881	Snowville	9	8	8 "
West Virginia	Morgantown	25	Morgantown	8	1880	Fort Monroe	15	56	56 "
Wisconsin	La Crosse	16	Milwaukee	-14	1875	Fort Colville	-8	20	20 "
Do						Helvetia	0	4	4 "
Wyoming	Fort Washakie	-23	Cheyenne	-20	1875	Neilsville	-28	8	8 "
						Fort Crawford	-13	25	25 "
						Fort Bridge	-40	24	24 "

comparative temperatures on the left-hand of chart ii. The following items of interest in connection with this subject are reported by voluntary observers:

**Illinois:** Riley, mean temperature 36°.6, or 3°.7 above the November average of the last twenty-one years. The mean temperature of the autumn of 1882, is 3°.5 above the autumn average of the past twenty-one years.

**Indiana:** Logansport, mean temperature 42°.3, or 2°.3 above the November average of a period of twenty-three years. During that period, the highest November mean, 48°, occurred in 1862; the lowest, 30°.3, occurred in 1880; the highest maximum, 80°, occurred in 1874; lowest minimum, -14°, occurred in 1880. Saint Meinrad, mean temperature 43°.2, or 1°.64 below the November mean of the past seven years.

**Iowa:** Iowa City, the following extract is taken from "Press Bulletin," number 115, for November, 1882, published by Dr. Gustavus Hinrichs, Director of the Iowa Weather Service: The mean temperature was nearly 2° above the twenty years normal. The first decade of the month was over 7° above the normal, and the last two decades averaged about .5° below the normal. Clinton, mean temperature, 37°.2, or 3°.2 above the November average.

**Kansas:** Wellington, mean temperature, 40°.1, or 1°.8 above the average of the last three years. The highest mean of that period, 45°.5, occurred in 1879; the lowest, 29°, occurred in 1880. Lawrence, mean temperature, 43°.07, or 4°.12 above the November average the past fifteen years. During that period, the highest November mean, 45°.87, occurred in 1878; the lowest, 31°.58, occurred in 1880; the highest maximum temperatures, 78° and 80°, occurred in 1873 and 1882, respectively; the lowest minimum, -1° occurred in 1872.

**Maine:** Gardiner, mean temperature, 35°.42, or 0°.19 below the November average of the past forty-six years.

**Maryland:** Fallston, mean temperature, 40°.06, or 1°.04 below the average of the last twelve years. During that period, the highest November means, 46°.71 and 46°.14, occurred in 1870 and 1881, respectively; the lowest, 37°.5, occurred in 1873.

**Missouri:** Saint Louis, the Missouri Weather Service reports the mean temperature to be 2° above the November average.

**New York:** North Volney, mean temperature, 35°.27, or 0°.2 above the November average of the last fourteen years. During that period, the highest November mean, 38°.74, occurred in 1877; the lowest, 29°.49, occurred in 1873. The mean temperature of the autumn of 1882, 49°.47, is 1°.18 above the autumnal average of the last fourteen years. During that period, the highest autumnal mean temperature, 52°.5, occurred in 1881; the lowest, 44°.03, occurred in 1875. Palermo, mean temperature, 33°.6, or 0°.7 below the November average of the last twenty-nine years. During that period, the highest November mean, 41°.8, occurred in 1859; the lowest, 26°.8, occurred in 1873. The mean temperature of the autumn of 1882 is 43°.5, or 3°.5 below the average autumnal mean of the past twenty-nine years.

**Ohio:** Cleveland, mean temperature, 39°.97, or 0°.28 above the November average of the last twenty-eight years. During that period, the highest November average was 44°.53, and the lowest was 31°.91.

**Vermont:** Woodstock, mean temperature, 30°.99, or 0°.37 above the November average of the last fifteen years. During that period, the highest November mean, 36°.59, occurred in 1877; the lowest, 22°.46, occurred in 1873; the highest November maximum temperature, 73°.2, occurred in 1876; the lowest, -16°.5, occurred in 1875.

**Virginia:** Wytheville, mean temperature, 40°.83, or 1° below the November average of the past eighteen years.

**West Virginia:** Helvetia, mean temperature, 40°.44, or 0°.26 below the November average of the past six years.

#### RANGES OF TEMPERATURE AT SIGNAL SERVICE STATIONS.

The monthly ranges of temperature during November, 1882, have varied from 19° at San Francisco, California, and 28° at Key West, Florida, to 81° at Cheyenne, Wyoming. The smallest monthly ranges are: San Francisco, California, 19°; Key

Table of Maximum and Minimum Temperatures for November, 1882.

State or Territory.	Signal Service.			U. S. Army Post Surgeons, or Voluntary Observers.		
	Station.	Max.	Min.	Station.	Max.	Min.
Alabama.....	Montgomery.....	83	29	Mount Vernon Barracks.....	86	26
Do.....	Do.....			Auburn.....	81	24
Arizona.....	Phoenix.....	92	24	Mount Ida.....	76	17
Do.....	Fort Apache.....	72	13	Borden.....	90	30
Arkansas.....	Fort Smith.....	86	22	Mammoth Tank.....	90	44
California.....	Los Angeles.....	81	36	Cisco.....	50	10
Do.....	Red Bluff.....	64	29	Fort Lyon.....	71	1
Colorado.....	West Las Animas.....	69	-1	Pagosa Springs.....	70	-23
Do.....	Pike's Peak.....	30	-26	Southington.....	71	57
Connecticut.....	New Haven.....	72	16	Fort Meade.....	71	-3
Do.....	New London.....	72	17	Fort Lincoln.....	50	-8
Dakota.....	Rapid City.....	67	-2	Rock Creek.....	82	27
Do.....	Fort Buford.....	85	-3	Fort Barrancas.....	87	25
Delaware.....	Del. Breakwater.....	72	29	Forsyth.....	91	28
District of Columbia.....	Washington.....	79	24	Anna.....	82	25
Florida.....	Sanford.....	87	41	Elmira.....	73	26
Do.....	Pensacola.....	81	30	Mitchell.....	81	20
Georgia.....	Augusta.....	83	33	Miami.....	74	8
Do.....	Atlanta.....	80	29	Indianola.....	76	12
Idaho.....	Eagle Rock.....	61	-14	Humboldt.....	60	4
Illinois.....	Cairo.....	80	28	Clay Centre.....	83	12
Do.....	Champaign.....	73	15	Bowling Green.....	84	28
Indiana.....	Indianapolis.....	72	22	Frankfort.....	73	17
Do.....	Do.....			Fort Preble.....	69	23
Indian Territory.....	Fort Supply.....	84	9	Cornish.....	64	12
Iowa.....	Keokuk.....	74	18	Emmitsburg.....	77	5
Do.....	Davenport.....	65	13	New Bedford.....	73	16
Kansas.....	Dodge City.....	78	7	Williamstown.....	66	2
Kentucky.....	Louisville.....	75	29	Coldwater.....	62	21
Do.....	Do.....			Fort Brady.....	57	7
Louisiana.....	Shreveport.....	86	29	Northfield.....	56	4
Maine.....	Portland.....	66	21	Minneapolis.....	53	4
Do.....	Eastport.....	64	20	Fayette.....	81	24
Maryland.....	Baltimore.....	73	26	Protem.....	82	30
Massachusetts.....	Boston.....	72	19	Oregon.....	80	12
Do.....	Springfield.....	69	16	Fort Ellis.....	62	-17
Michigan.....	Detroit.....	69	30	Lincoln.....	94	17
Do.....	Port Huron.....	68	10	Fort Niobrara.....	71	0
Minnesota.....	Saint Paul.....	54	6	Golconda.....	78	15
Do.....	Moorhead.....	48	-7	Boca.....	17	-5
Mississippi.....	Vicksburg.....	84	31	Concoctookville.....	68	11
Do.....	Starkville.....	80	29	New Market.....	68	18
Missouri.....	Saint Louis.....	76	22	Grafton.....	64	11
Do.....	Springfield.....	75	20	South Orange.....	77	13
Montana.....	Fort Keogh.....	63	-6	Pateron.....	63	13
Do.....	Terry's Landing.....	62	-15	Fort Union.....	75	-4
Nebraska.....	Omaha.....	74	14	Lordsburg.....	76	30
Do.....	North Platte.....	64	5	Fort Columbus.....	76	23
Nevada.....	Pioche.....	62	6	Johnstown.....	70	-6
Do.....	Do.....			Weldon.....	82	23
New Hampshire.....	Mt. Washington.....	44	-7	Lenoir.....	77	23
Do.....	Do.....			College Hill.....	76	25
New Jersey.....	Little Egg Harbor.....	75	22	Ruggles.....	72	10
Do.....	Atlantic City.....	72	21	Dyberry.....	67	-1
Do.....	Fort Bayard.....	75	21	Fort Adams.....	73	21
New Mexico.....	Santa Fe.....	65	6	Stateburg.....	81	22
Do.....	New York City.....	74	25	Aiken.....	80	22
New York.....	Buffalo.....	68	17	Austin.....	84	25
Do.....	Rochester.....	62	17	Kelton.....	58	0
North Carolina.....	Life-saving Station No. 6.....	80	30	Charlotte.....	69	14
Do.....	Charlotte.....	78	28	Woodstock.....	68	8
Ohio.....	Cincinnati.....	72	26	Johnsontown.....	81	31
Do.....	Columbus.....	72	22	Variety Mills.....	77	18
Do.....	Cleveland.....	72	20	Wytheville.....	75	18
Do.....	Sandusky.....	70	19	Fort Canby.....	60	27
Oregon.....	Roseburg.....	61	23	Helvetia.....	74	20
Do.....	Umatilla.....	58	15	Beloit.....	81	16
Do.....	Pittsburg.....	74	22	Ripon.....	63	10
Pennsylvania.....	Williamsport.....	67	14	Fort Washakie.....	57	-25
Do.....	Do.....					
Rhode Island.....	Narragansett Pier.....	72	15			
Do.....	Point Judith.....	70	15			
South Carolina.....	Charleston.....	80	36			
Do.....	Do.....					
Tennessee.....	Memphis.....	81	29			
Do.....	Nashville.....	81	28			
Do.....	Knoxville.....	78	27			
Texas.....	Eagle Pass.....	90	33			
Do.....	Fort Elliott.....	81	14			
Utah.....	Salt Lake City.....	70	7			
Vermont.....	Burlington.....	66	17			
Do.....	Do.....					
Virginia.....	Lynchburg.....	80	27			
Do.....	Do.....					
Washington Ter.....	Almota.....	58	20			
Do.....	Dayton.....	58	15			
Do.....	Colfax.....	56	10			
West Virginia.....	Morgantown.....	72	25			
Wisconsin.....	Milwaukee.....	70	21			
Do.....	La Crosse.....	58	16			
Wyoming.....	Cheyenne.....	65	-15			
Do.....	Fort Washakie.....	56	-23			

West, Florida, 28°; Olympia, Washington Territory, 30°; Portland, Oregon, 31°; Sacramento, California, 32°; Lewiston, Idaho, and Marquette, Michigan, 34°; Cape Mendocino, California, 35°. The largest are: Concho, El Paso and Palestine,



Texas, Fort Sill, Indian Territory, Omaha, Nebraska, and Huron, Dakota, 60°; Fredericksburg, Texas, 61°; Henrietta, Texas, 62°; Coleman City and Uvalde, Texas, Fort Benton, Montana, and Salt Lake City, Utah, 63°; Fort Apache, Arizona, Graham, Texas, and Fort Smith, Arkansas, 64°; Fort Meade, Dakota, 65°; Forts Elliott and Stockton, Texas, and Deer Lodge, Montana, 67°; Phoenix, Arizona, 68°; Fort Keogh, Montana, Rapid City, Dakota, and Denver, Colorado, 69°; West Las Animas, Colorado, 70°; Dodge City, Kansas, 71°; Fort Custer, Montana, 72°; Eagle Rock, Idaho, 75°; Fort Washakie, Wyoming, 80°; Cheyenne, Wyoming, 81°.

The greatest daily ranges have varied in the different districts, as follows:

*New England:* From 18° at Provincetown, Massachusetts, on the 11th to 33° on the summit of Mount Washington, New Hampshire, on the 30th.

*Middle Atlantic states:* From 20° Chincoteague, Virginia, on the 15th, to 30° at Washington, District of Columbia, on the 13th.

*South Atlantic states:* From 20° at Hatteras, North Carolina, on the 26th, to 29° at Augusta, Georgia, on the 3d.

*Florida peninsula:* From 14° at Key West, on the 20th, to 24° at Cedar Keys on the 17th, and 39° at Sanford on the 29th.

*East Gulf states:* From 20° at New Orleans, Louisiana, on the 16th, to 28° at Vicksburg, Mississippi on the 13th, and 28° at Montgomery, Alabama, on the 23d.

*West Gulf states:* From 20° at Port Eads, Louisiana, on the 16th, to 33° at Fredericksburg, Texas, on the 30th, and 41° at Fort Smith, Arkansas, on the 14th.

*Rio Grande valley:* From 32° at Brownsville, Texas, on the 13th, to 33° at Eagle Pass, Texas, on the 21st and 22d.

*Ohio valley and Tennessee:* From 20° at Louisville, Kentucky, on the 16th, to 30° at Indianapolis, Indiana, on the 12th, and 31° at Knoxville, Tennessee, on the 8th.

*Lower lake region:* From 18° at Sandusky, Ohio, on the 12th, to 26° at Detroit, Michigan, on the 12th.

*Upper lake region:* From 17° at Duluth, Minnesota, on the 24th, to 32° at Chicago, Illinois, on the 12th.

*Extreme northwest:* From 28° at Saint Vincent, Minnesota, on the 13th, to 36° at Bismarck and Fort Stevenson, Dakota, on the 30th.

*Northern slope:* From 20° at Helena, Montana, on the 13th, to 44° at Cheyenne, Wyoming, on the 2d and 44° at North Platte, Nebraska, on the 13th.

*Middle slope:* From 27° on the summit of Pike's Peak, Colorado, on the 11th, to 51° at West Las Animas, Colorado, on the 15th.

*Southern slope:* From 30° at Jacksborough, Texas, on the 14th and 15th, to 42° at Fort Sill, Indian Territory, on the 14th.

*Southern plateau:* From 29° at Fort Grant, Arizona, on the 14th, and 36° at Santa Fé, New Mexico, on the 14th, to 50° at Fort Apache, Arizona, on the 6th.

*Middle plateau:* From 27° at Salt Lake City, Utah, on the 3d, to 37° at Fort Washakie, Wyoming, on the 12th.

*Northern plateau:* From 22° at Spokane Falls, Washington Territory, on the 9th and 12th, and 22° at Lewiston, Idaho, on the 28th, to 46° at Fort Missoula, Montana, on the 6th.

*North Pacific coast region:* From 23° at Portland, Oregon, on the 4th, to 26° at Olympia, Washington Territory, and Roseburg, Oregon, on the 12th.

*Middle Pacific coast region:* From 14° at San Francisco, California, on the 15th, to 28° at Red Bluff, California, on the 14th.

*South Pacific coast region:* From 28° at San Diego, California, on the 14th, to 37° at Los Angeles, California, on the 14th.

#### FROSTS.

In the various districts they were reported on the following dates:

*New England:* 2d to 6th, 8th to 30th.

*Middle Atlantic states:* 3d to 9th, 12th, 14th, 15th, 16th, 18th to 30th.

*South Atlantic states:* 5th to 9th, 13th to 17th, 19th to 30th.

*East Gulf states:* 6th, 14th, 15th, 16th, 21st, 22d, 23d, 29th, 30th.

*West Gulf states:* 5th, 12th to 14th, 18th to 25th, 28th, 29th, 30th.

*Rio Grande valley:* 20th, 21st, 22d, 28th, 29th, 30th.

*Tennessee:* 5th, 7th, 8th, 13th to 16th, 18th to 25th, 27th to 30th.

*Ohio valley:* 3d to 9th, 11th to 16th, 18th to 25th, 27th to 30th.

*Lower lake region:* 1st to 8th, 13th, 14th, 15th, 17th to 21st, 24th, 27th, 30th.

*Upper lake region:* 1st to 5th, 8th, 9th, 10th, 12th to 30th.

*Extreme northwest:* 1st to 4th, 6th to 30th.

*Upper Mississippi valley:* 1st to 4th, 7th, 8th, 9th, 12th to 30th.

*Missouri valley:* 2d, 3d, 4th, 6th to 24th, 26th to 30th.

*Northern slope:* 1st to 30th.

*Middle slope:* 1st, 2d, 4th to 10th, 12th to 15th, 17th to 30th.

*Southern slope:* 6th, 12th to 15th, 20th, 21st, 27th to 30th.

*Southern plateau:* 1st to 6th, 10th to 24th, 26th to 30th.

*Middle plateau:* 2d, 5th to 8th, 10th to 30th.

*Northern plateau:* 1st to 20th, 23d to 29th.

*North Pacific coast region:* 4th, 7th to 12th, 15th to 18th, 23d, 24th, 25th, 27th, 28th, 29th.

*Middle Pacific coast region:* 1st, 4th to 7th, 10th to 15th, 17th to 25th, 28th.

*South Pacific coast region:* 2d, 19th, 22d.

#### ICE.

The subject of the formation of ice in the northern sections, is considered elsewhere in the REVIEW, under the heading ICE IN RIVERS AND HARBORS. The following are exceptional cases of ice formation in the southern sections of the country.

*Alabama:* Auburn, 14th, 29th, 30th; Mobile, 30th.

*Arizona:* Wickenburg, 13th.

*Arkansas:* Fort Smith, 13th, 29th, 30th.

*California:* Princeton, 11th.

*Florida:* Pensacola, 30th.

*Georgia:* Atlanta, 22d; Savannah, 30th.

*Louisiana:* Shreveport, 13th.

*Mississippi:* Fayette, 29th; Vicksburg, 14th.

*North Carolina:* Charlotte, 30th; Fort Macon, 30th; Kitty-hawk, 15th, 25th, 26th; Smithville, 22d.

*Oregon:* Portland, 10th, 11th.

*South Carolina:* Stateburg, 23d.

*Tennessee:* Ashwood, 7th, 13th, 14th; Austin, 13th, 14th, 21st, 22d, 23d; Knoxville, 14th; Memphis, 3d, 4th, 28th, 29th; Nashville, 14th.

*Texas:* Coleman City, 13th, 29th, 30th; Denison, 29th, 30th; Fort Concho, 13th, 14th, 30th; Fort Davis, 17th to 20th; Indianola, 30th; Palestine, 30th.

*Virginia:* Johnstown, 15th, 18th to 22d, 26th; Norfolk, 26th; Variety Mills, 26th.

#### PRECIPITATION.

(Expressed in inches and hundredths.)

The distribution of rainfall over the United States and Canada, as determined from observations taken at more than six hundred stations, is exhibited on chart iii. The table in the lower left-hand corner of this chart shows the average monthly rainfall, determined from the records of Signal Service stations, in the several districts, it shows also the excess or deficiency of precipitation as compared with the average of many years.

In California, and over the southern part of the country from Arizona to the Mississippi river, in Florida, and in the extreme northwest, the rainfall has been greater than the November average. In northern California, the excess amounts to 2.13; the southern slope, 1.34; and in other districts named, it varies from 0.05 in southern California, to 0.87 in the Rio Grande valley. Throughout the rest of the country, there has been a deficiency in the monthly rainfall. The largest deficiencies occurred as follows: 2.98 in New England; 2.38 in the north Pacific coast region; 2.41 in the middle Atlantic states; and 1.90 in the east Gulf states. In all other districts, embraced in the area of de-

iciency, the departures from the monthly average vary from 0.06 in the upper Mississippi valley and 0.08 in the Missouri valley to 0.73 in the lower lake region and 0.89 in the Ohio valley.

#### DEVIATIONS FROM AVERAGE PRECIPITATION.

Under this heading, departures exhibited by the regular Signal Service stations are shown in the table of comparative monthly rainfalls, as published in the lower left-hand corner of chart iii. The following items of interest in connection with this subject are reported by voluntary observers:

**Illinois:** Riley, monthly precipitation 1.52, or 0.38 below the November average of the last twenty-one years. The total precipitation for the autumn of 1882, is 0.04 below the average of the same period.

**Indiana:** Logansport, monthly precipitation, 3.03, is slightly above the November average of the last twenty-three years. During that period, the largest November precipitation, 6.30, occurred in 1864; the smallest, 0.41, occurred in 1861. The largest November snowfall, eighteen and one-half inches, fell during the entire month.

**Iowa:** Iowa City, the following extract is taken from "Press Bulletin," number 115, for November, 1882, published by Dr. Gustavus Hinrichs, Director of the Iowa Weather Service: The rainfall of the month was above the normal over a belt of country extending across the state from southwest to northeast. In the northwestern part of the state it was normal, while in the southeastern section it was decidedly below the normal.

Clinton, monthly precipitation 1.40, or 0.88 below the November average.

**Kansas:** Wellington, monthly precipitation 1.65, or 0.39 above the average of the last three years. During that period, the largest November precipitation, 1.98 inches, occurred in 1881; the smallest, 0.70, occurred in 1880; the total precipitation for the eleven months ending November 30th, 35.33, or 6.66 above the average of the corresponding months of the past three years. Lawrence, monthly precipitation 2.08, or 0.01 below the November average of the last fifteen years. During that period, the largest monthly precipitation, 5.15, occurred in 1879; the least, 0.01, occurred in 1872. The total precipitation for the eleven months ending November 30th, 26.36, or 6.77 below the average of the corresponding months of the last fourteen years.

**Maine:** Gardiner, monthly precipitation, 1.14, is the least November precipitation that has occurred during the past forty-six years, and is 3.23 below the average of the same period. With the exception of the present year, the least November precipitation, 2.56, occurred in 1856.

**Maryland:** Fallston, monthly precipitation 0.47, or 3.49 below the November average of the last twelve years. During that period, the largest November precipitation, 10.27, occurred in 1877; the least, with the exception of the present year, occurred in 1879.

**Massachusetts:** Worcester, monthly precipitation 1.23, or 2.62 below the November average; the total precipitation for the eleven months ending November 30th, 41.53, or 1.11 below the average of the corresponding months of previous years.

**Missouri:** The Missouri Weather Service reports the monthly precipitation at Saint Louis to be about 3.00, which is the normal value for November.

**New Hampshire:** Grafton, monthly precipitation, 0.86, is the smallest November precipitation that has occurred during the last four years.

**New York:** North Volney, monthly precipitation 1.45, or 2.45 below the average of the last ten years. During that period the largest November precipitation, 5.65, occurred in 1880; the smallest, 2.38, (with the exception of the present year,) occurred in 1872. The total precipitation for the autumn of 1882 is 5.40, which is 4.38 below the average of the last ten years. During that period the largest autumnal precipitation, 12.35, occurred in 1873; the smallest, 8.37, (with the exception of the present year,) occurred in 1881. Palermo, monthly precipitation, 0.74, or 2.80 below the average of the last twenty-

Table of Excessive, Greatest and Least Monthly Rainfalls.

STATION.	SPECIAL HEAVY.			Largest Monthly.	SMALLEST MONTHLY.	
	Date.	Amt.	Duration	Amount.	STATION.	Amt.
<i>Arkansas.</i>					<i>Arizona.</i>	
Little Rock.....	12	1.83		6.17	Casa Grande.....	0.00
Mount Ida.....				5.70	Maricopa.....	0.00
<i>California.</i>				5.64	Yuma.....	0.08
Alta.....					Texas Hill.....	0.12
Red Bluff.....	2, 3	4.06			San Simon.....	0.30
Alcatraz Island.....	1, 2	3.87			<i>California.</i>	
Angel Island.....	2, 3	3.85			Mo'ave.....	0.00
San Francisco.....	2, 3	3.45			Tehachapi.....	0.18
Point San José.....	2, 3	3.04			Colton.....	0.19
Benicia Barracks.....	2, 3	2.65			Mammoth Tank.....	0.20
<i>Florida.</i>				5.70	Havenna.....	0.24
Jacksonville.....					Keene.....	0.25
Fort Barrancas.....	26, 27	3.15	21 h.		Grafton.....	0.28
Pensacola.....	26, 27	2.57			San Diego.....	0.39
Cedar Keys.....	1	1.20	2h. 16m.		Sumner.....	0.42
<i>Georgia.</i>					<i>Colorado.</i>	
Augusta.....	20, 21	2.66			West Las Animas.....	0.01
<i>Illinois.</i>				6.04	Pike's Peak.....	0.22
Anna.....				5.96	Fort Garland.....	0.36
Cairo.....					<i>Dakota.</i>	
<i>Louisiana.</i>				8.62	Fort Randall.....	1.00
Shreveport.....	26, 27	3.71			Fort Meade.....	0.15
<i>Michigan.</i>					Smithville.....	0.20
Traverse City.....	11	4.02			Olivet.....	0.25
Northport.....	10, 11	3.30			Fort Buford.....	0.29
Do.....	13	2.45			Fort Stevenson.....	0.31
Alpena.....	11	2.28			Fort Yates.....	0.32
<i>Mississippi.</i>				7.43	Fort Sully.....	0.40
Starkville.....	26, 27	3.64			Fort A. Lincoln.....	0.45
Do.....	19, 20	2.19			Bismarck.....	0.46
<i>Missouri.</i>				6.30	Fort Bennett.....	0.50
Springfield.....	8, 9	3.35		5.81	Fort Hale.....	0.50
Curryville.....				5.80	Morristown.....	0.50
Pierce City.....					<i>Idaho.</i>	
<i>New York.</i>				5.75	Boise City.....	0.08
White Plains.....					Coeur d'Alene.....	0.29
<i>North Carolina.</i>					Eagle Rock.....	0.49
Kittyhawk.....	28, 29	3.87			<i>Iowa.</i>	
Hatteras.....	28	3.03			Nora Springs.....	0.30
Fort Mason.....	28	2.41			<i>Kansas.</i>	
<i>Oregon.</i>				7.11	Clay Centre.....	0.07
Portland.....					Salina.....	0.09
<i>Texas.</i>				8.63	Dodge City.....	0.11
Palestine.....	25, 26	2.98		7.63	<i>Maryland.</i>	
New Ulm.....					Fort McHenry.....	0.06
Brownsville.....	13	2.60			Woodstock.....	0.10
					Fallston.....	0.47
					Owings Mills.....	0.49
					<i>Massachusetts.</i>	
					Dudley.....	0.45
					<i>Montana.</i>	
					New Chicago.....	0.04
					Deer Lodge.....	0.08
					Fort Custer.....	0.15
					Helena.....	0.16
					Fort Assiniboine.....	0.16
					Fort Keogh.....	0.19
					Glendive.....	0.20
					Fort Shaw.....	0.30
					Fort Beaton.....	0.39
					Fort Maginnis.....	0.40
					Terry's Landing.....	0.43
					Carriersville.....	0.48
					Poplar River.....	0.48
					<i>Nebraska.</i>	
					Fort Niobrara.....	0.00
					North Platte.....	0.01
					Lincoln.....	0.33
					Genoa.....	0.35
					<i>Nevada.</i>	
					Elko.....	0.04
					Otago.....	0.05
					Halleck.....	0.10
					Battle Mountain.....	0.15
					Tecoma.....	0.25
					Wadsworth.....	0.25
					Reno.....	0.40
					Hot Springs.....	0.41
					<i>Utah.</i>	
					Kelton.....	0.00
					Terrace.....	0.00
					Corinne.....	0.15
					Ogden.....	0.37
					<i>Wyoming.</i>	
					Cheyenne.....	0.06
					Fort Bridger.....	0.48

nine years, and is the smallest for any November during that period. The largest November precipitation, 8.30, occurred in 1863. The monthly snowfall, 5 inches, is 3.80 below the November average. During the last twenty-nine years the largest November snowfall, 39 inches, fell in 1830; the smallest, 2 inches, fell in 1879.

**Vermont:** Woodstock, monthly precipitation 0.61, or 2.39 below the November average of the last 14 years. During that period the largest November precipitation, 4.95, occurred in 1877; the smallest is that of the present year.



*West Virginia*; Helvetia, monthly precipitation 2.76, or 1.86 below the November average of the past six years.

The following table shows the greatest and least numbers of rainy and cloudy days, and percentages of mean relative humidity, as reported from the various districts:

*Table of rainy and cloudy days and relative humidity for November, 1882.*

Districts.	Rainy days	Cloudy days.	Relative humidity. *
			Percentages.
New England.....	From 6 to 15	From 5 to 13	From 61.3 to 77.1
Middle Atlantic states.....	" 7 " 14	" 5 " 13	" 62.5 " 79.9
South Atlantic states.....	" 4 " 11	" 6 " 11	" 66.0 " 76.3
Florida peninsula.....	" 4 " 7	" 2 " 3	" 71.9 " 78.0
East Gulf states.....	" 6 " 11	" 4 " 9	" 69.1 " 77.0
West Gulf states.....	" 5 " 13	" 3 " 14	" 67.5 " 77.8
Rio Grande valley.....	" 5 " 9	" 5 " 8	" 61.8 " 76.5
Ohio valley and Tennessee.....	" 9 " 19	" 7 " 14	" 62.8 " 76.5
Lower lake region.....	" 15 " 19	" 12 " 18	" 68.4 " 78.9
Upper lake region.....	" 12 " 19	" 12 " 21	" 74.7 " 83.7
Extreme northwest.....	" 9 " 13	" 5 " 13	" 78.8 " 84.5
Upper Mississippi valley.....	" 9 " 16	" 5 " 14	" 68.1 " 90.4
Missouri valley.....	" 2 " 13	" 3 " 11	" 64.5 " 77.5
Northern slope.....	" 1 " 9	" 1 " 6	" 58.1 " 71.2
Middle slope.....	" 1 " 5	" 1 " 3	" 50.9 " 70.3
Southern slope.....	" 5 " 8	" 5 " 9	" 63.4 " 75.2
Southern plateau.....	" 1 " 9	" 2 " 8	" 48.7 " 60.3
Middle plateau.....	" 4 " 7	" 3 " 4	" 47.8 " 71.1
Northern plateau.....	" 1 " 15	" 1 " 14	" 67.1 " 83.9
North Pacific coast region.....	" 12 " 17	" 11 " 14	" 76.7 " 82.1
Middle Pacific coast region.....	" 7 " 11	" 4 " 7	" 76.9 " 77.7
South Pacific coast region.....	" 3 " 5	" 3 " 6	" 45.1 " 77.6

\* Relative humidity corrected for altitude.

#### HAIL.

Cairo, Illinois, 9th: A very heavy wind storm, accompanied by thunder and hail, occurred between 11.30 and 11.45 p. m. The hail-stones were about the size of grapes, and caused slight damage, chiefly in breaking window-glass.

Palestine Texas, 6th: During a thunder-storm, a heavy shower of hail fell from 2.00 to 2.10 p. m.

Fort Apache, Arizona, 16th: A heavy fall of hail occurred during the evening of this date.

Fort Scott, Kansas, 4th: Hail storm with violent thunder and lightning; hail fell for five minutes, covering the ground.

Burlington, Vermont, 24th.

Cape Mendocino, California, 1st, 21st.

Fort Union, New Mexico, 8th.

Anna, Illinois, 10th.

Vevay, Indiana, 13th.

Nora Springs, Iowa, 10th, 11th.

Clay Centre, Kansas, 16th.

Fort Scott, Kansas, 4th.

Cornish, Maine, 8th.

Somerset, Massachusetts, 29th.

Lansing, Michigan, 12th.

Northport, Michigan, 2d.

Nebraska City, Nebraska, 11th.

College Hill, Ohio, 13th.

#### SNOW.

The dates on which snow fell in the various districts are as follows:

*New England*: 1st to 5th, 7th, 8th, 9th, 13th, 14th, 16th, 17th, 18th, 20th, 23d to 30th.

*Middle Atlantic states*: 7th, 14th, 17th to 20th, 24th to 30th.

*Ohio valley*: 13th, 18th, 19th, 24th to 30th.

*Lower lake region*: 13th, 14th, 16th, 17th, 19th, 20th, 22d to 30th.

*Upper lake region*: 1st, 2d, 3d, 11th to 30th.

*Extreme northwest*: 1st, 2d, 4th, 5th, 9th to 12th, 14th to 17th, 20th, 22d to 28th, 30th.

*Upper Mississippi valley*: 12th, 13th, 14th, 17th, 22d, 23d, 25th to 29th.

*Missouri valley*: 1st, 5th, 10th, 11th, 12th, 15th, 16th, 17th, 19th, 22d, 23d, 26th to 29th.

*Northern slope*: 1st, 2d, 4th, 9th, 10th, 11th, 14th to 17th, 22d, 24th to 27th.

*Middle slope*: 10th, 11th, 12th, 15th to 19th.

*Southern slope*: 17th, 18th, 19th.

*Southern plateau*: 9th to 12th, 15th to 18th, 24th, 25th.

*Middle plateau*: 9th, 10th, 11th, 14th, 15th.

*Northern plateau*: 1st, 2d, 3d, 9th, 10th, 13th, 14th, 15th, 18th to 22d, 24th, 25th, 26th.

The following are exceptional cases of snowfall in Southern states:

*Alabama*: Montgomery, 9th.

*California*: Fort Bidwell, 2d, 26th.

*Georgia*: Atlanta, 20th, 29th; Augusta, 20th, 21st.

*Mississippi*: Starkville, 29th, light flurry of snow from 8.10 to 8.45 a. m.

*North Carolina*: Lenoir, 28th; Weldon, 28th; Cape Lookout, 21st.

*Oregon*: Roseburg, 1st, snow observed on mountains west of station.

*South Carolina*: Stateburg, 30th.

*Tennessee*: Austin, 29th; Murfreesboro, 29th.

*Texas*: Denison, 19th, 20th.

#### LARGEST MONTHLY SNOWFALLS.

[Expressed in inches.]

The following are the largest monthly snowfalls reported from the various states and territories during the month:

*California*: Summit, 39½; Cisco, 37½; Emigrant Gap, 21½; Berryvale, 13.

*Colorado*: Pagosa Springs, 24; Denver, 7.

*Connecticut*: Southington, 15½; New London, 15; New Haven, 10½.

*Dakota*: Fort Stevenson, about 6; Huron, 3.

*Delaware*: Delaware Breakwater, 5.

*Idaho*: Eagle Rock, 4.

*Illinois*: Springfield, about 7; Morrison, 5; Polo, 3½.

*Indiana*: Wabash, 8; Logansport, 8; Fort Wayne, 7; Lafayette, 6.

*Iowa*: Ames, 5; Keokuk, 4½; Cresco, 4; Clinton, 4.

*Kansas*: Salina, 5.

*Maine*: Cornish, 8; Eastport, 6½; Portland, 6; Gardiner, 5½; Dexter, 3.

*Maryland*: Fallston, 5½; Cumberland, 5; Sandy Springs, 4½.

*Massachusetts*: South Lee, 21; Somerset, 13; Provincetown, about 13; Westborough, 12; Princeton, 11½; Charleston, 10½; Springfield, 10½; Boston, 10; Fall River, 10; Menden, 10; Milton, 20; Worcester, 9½; Amherst, 7½; Fort Warren, 6½; New Bedford, 5½; Rowe, 5; Dudley, 4.

*Michigan*: Mackinac City, 19½; Port Huron, 13; Traverse City, 10; Marquette, 7½; Escanaba, 5; Kalamazoo, 5; Thornville, 5; Marshall, 4½; Lansing, 3½; Detroit, 3.

*Minnesota*: Moorhead, 20; Minneapolis, 7½; Northfield, 7½; Saint Vincent, 5; Duluth, 4.

*Missouri*: Saint Louis, 4.

*Montana*: Fort Ellis, 7; Fort Benton, 4.

*Nevada*: Boca, 9; Truckee, 6.

*New Hampshire*: Mount Washington, 15½; Antrim, 10; New Market, 9½; Contoocookville, 9; Auburn, 8.

*New Jersey*: Paterson, 21; South Orange, 12; Phillipsburg, 10½; Freehold, 7½; Cape May, about 5½; Moorestown, 5½; Sandy Hook, about 4; Vineland, 3.

*New Mexico*: Santa Fé, about 7.

*New York*: White Plains, 22; Ardenia, 19; Nile, 19; Rochester, 18; Port Jervis, 17; Oswego, 14½; Flushing, 14; New York City, 12½; Factoryville, 10½; Buffalo, 10; Albany, 9; Penn Yan, 8½; Johnstown, 8½; Cooperstown, 7½; Ithaca, 7; North Volney, 6½; Hector, 5; Palermo, 5.

*Ohio*: Margaretta, 11½; New Riegel, 10½; Columbus, about 9; Cleveland, 8; Marion, 8; Ruggles, 7½; Sandusky, 6½; New Athens, 5½; North Lewisburg, 5½; Cincinnati, 4; Toledo, 4; Westerville, 4; College Hill, 3.

*Pennsylvania*: Blooming Grove, 15½; Dyberry, about 14; Erie, 9; Fallsington, 8½; Philadelphia, 6; Williamsport, 6; Wellsboro, 6; Pittsburg, 5½; West Chester, 5½; Catawissa, 4½.

*Vermont*: Woodstock, 5; Lunenburg, 3.

*Virginia*: Wytheville, 3.

*West Virginia*: Helvetia, 7½.

Wisconsin: Manitowoc, 9½; Franklin, 5½; Ripon, 4½; Madison, 3½; Milwaukee, about 3.

DEPTH OF UNMELTED SNOW ON GROUND AT END OF THE MONTH.

(Expressed in inches.)

Connecticut: Southington, 10; New London, 7½; New Haven, 6.

Dakota: Fort Stevenson, 1; Fort Buford, 1; Fort Bennett, trace; Bismarck, trace; Wicklow, trace.

District of Columbia: West Washington, 2; Washington, ½. Illinois: Polo, 2; Springfield, 2; Charleston, 1; Champaign, 1½; Morrison, ½; Cairo, trace; Chicago, trace.

Indiana: Wabash, 5; Logansport, 3; La Fayette, 2.

Iowa: Keokuk, 1½; Cedar Rapids, trace; Davenport, trace; Guttenburg, trace.

Maine: Cornish, 6; Gardiner, 4½; Eastport, 4½; Portland, 4. Maryland: Cumberland, 2; Fallston, 2; Sandy Springs, 2; Emmitsburg, ½; Baltimore, trace.

Massachusetts: Fall River, 6; Somerset, 6; Westborough, 5; Springfield, 4½; Boston, 4; Charleston, 4; Fort Warren, 4; Milton, 3; Williamstown, 3; Worcester, 2; Dudley, 1; Amherst, ½.

Michigan: Marquette, 4; Northport, 3½; Alpena, 2; Litchfield, 2; Mackinac City, 2; Thornville, 2; Escanaba, 1½; Lansing, 1; Port Huron, 1; Grand Haven, ½; Detroit, trace.

Minnesota: Minneapolis, 4; Moorhead, 3; Northfield, 3; Saint Paul, 2½; Duluth, 1½; Saint Vincent, 1.

Missouri: Saint Louis, 2½.

Montana: Fort Keogh, 1.

New Hampshire: Grafton, 6½; Mount Washington, 6; New Market, 5; Auburn, 4.

New Jersey: South Orange, 7; Paterson, 6; Freehold, 5; Moorestown, 3; Vineland, 3; Sandy Hook, ½; Atlantic City, trace.

New Mexico: Santa Fé, trace to 4.

New York: Ardenia, 12; White Plains, 12; Flushing, 11; Factoryville, 10; Nile, 10; Rochester, 9; Port Jervis, 8; Ithaca, 6; Cooperstown, 6; North Volney, 5½; New York City, 5; Oswego, 5; Buffalo, 4; Johnstown, 4; Albany, 3; Hector, 3; Penn Yan, 3; Palermo, 1½.

Ohio: Ruggles, 5; New Riegel, 4½; Cleveland, 4; Toledo, 3; Marion, 2; New Athens, 2; Westerville, 2; Columbus, 1; North Lewisburg, 1; Sandusky, 1; Bethel, ½; College Hill, trace.

Pennsylvania: Grampian Hills, 6½; Dyberry, 5; Fallsington, 4; Erie, 5; West Chester, 3½; Catawissa, 3; Williamsport, 3; Wellsboro, 2½; Philadelphia, 2; Pittsburgh, ½.

Rhode Island: Block Island, 1; Newport, trace.

Tennessee: Nashville, ½; Chattanooga, trace.

Vermont: Woodstock, 3; Burlington, 1.

Virginia: Lynchburg, 1½; Accotink, 1.

West Virginia: Morgantown, 1½.

Wisconsin: Ripon, 3; Franklin, 2; Beloit, ½; Madison, ½; La Crosse, trace; Milwaukee, trace.

Wyoming: Fort Washakie, 2½.

SNOW FROM A CLOUDLESS SKY.

College Hill, Ohio, 29th: During the evening, for several hours, a fine sprinkling snow fell, when the stars were visible and all parts of the heavens were perfectly clear.

SLEET.

Newport, Rhode Island, 29th.

Lynchburg, Virginia, 26th.

Washington, District of Columbia, 13th.

Barnegat, New Jersey, 29th.

Augusta, Georgia, 21st.

Charlotte, North Carolina, 20th, 27th.

Cape Lookout, North Carolina, 21st.

Little Rock, Arkansas, 24th.

Memphis, Tennessee, 19th.

Chattanooga, Tennessee, 20th.

Champaign, Illinois, 25th.

Cincinnati, Ohio, 26th.

Pittsburg, Pennsylvania, 23d.

Detroit, Michigan, 23d.

Toledo, Ohio, 13th.

Cleveland, Ohio, 26th.

Buffalo, New York, 13th, 19th, 24th.

Duluth, Minnesota, 11th.

Alpena, Michigan, 22d.

Mackinac City, Michigan, 12th.

Moorhead, Minnesota, 6th, 15th.

Springfield, Illinois, 25th.

Dubuque, Iowa, 23d.

Keokuk, Iowa, 25th.

Leavenworth, Kansas, 16th, 17th.

Springfield, Missouri, 25th.

Cheyenne, Wyoming, 15th.

Fort Maginnis, Montana, 26th.

Coleman City, Texas, 18th, 19th.

Fort Davis, Texas, 18th.

Fort Verde, Arizona, 10th.

Umatilla, Oregon, 17th.

Auburn, Alabama, 25th.

Alexandria, Dakota, 11th.

Vevay, Indiana, 12th.

Rowe, Massachusetts, 13th.

Wellsborough, Pennsylvania, 25th.

Stateburg, South Carolina, 20th.

Aiken, South Carolina, 21st.

Snowville, Virginia, 28th.

Variety Mills, Virginia, 26th.

WINDS.

The prevailing direction of the winds during the month of November, 1882, at Signal Service stations, are shown on chart ii., by arrows flying with the wind. The prevailing winds along the Atlantic coast, from New England to Florida, are from northwest to northeast; in the upper lake region, the extreme northwest, and the upper Mississippi and Missouri valleys, they are generally northwesterly; in the Gulf states most are from the south; elsewhere throughout the country, they are variable.

TOTAL MOVEMENTS OF THE AIR.

(In miles.)

The following are the largest total movements at the Signal Service stations: On the summit of Mount Washington, New Hampshire, 21,708; Pike's Peak, Colorado, 15,302; Delaware Breakwater, Delaware, 13,583; Block Island, Rhode Island, 13,220; Kittyhawk, North Carolina, 12,991; Hatteras, North Carolina, 12,406; Cape May, New Jersey, 12,263; Sandy Hook, New Jersey, 10,944; Barnegat, New Jersey, 10,635; Cape Henry, Virginia, 10,498; Indianola, Texas, 10,078; Port Eads, Louisiana, 10,062; Sandusky, Ohio, 9,836; Chincoteague, Virginia, 9,715; Fort Macon, North Carolina, 9,694; Eastport, Maine, 9,238; Key West, Florida, 8,976; Mackinac City, Michigan, 8,415; Fort Shaw, Montana, 8,098; Provincetown, Massachusetts, 8,087; Milwaukee, Wisconsin, 8,058. The smallest are: Visalia, California, 1,530; Roseburg, Oregon, 1,568; Fort Missoula, Montana, 1,885; Lynchburg, Virginia, 2,111; Lewiston, Idaho, 2,177; Olympia, Washington Territory, 2,289; Deadwood, Dakota, 2,301; Tucson, Arizona, 2,461; Boise City, Idaho, 2,601; Salt Lake City, Utah, 2,613; Spokane Falls, Washington Territory, 2,660; Fort Washakie, Wyoming, 2,753; El Paso, Texas, 2,873; Keokuk, Iowa, 2,898.

HIGH WINDS.

On the summit of Mount Washington, New Hampshire, velocities of 50 miles or more per hour occurred on all days during the month, with the exception of the following dates: 4th to 10th, 17th, 18th, 22d, 29th. The following were the highest velocities reported from this station: 87, nw., 1st; 76, nw., 11th; 81, sw., 13th; 88, nw., 20th; 98, nw., 25th (maximum for month); 88, nw., 26th.

On the summit of Pike's Peak, Colorado, the highest velocities were: 72, w., 2d; 62, sw., 3d; 72, sw., 4th; 59, sw., 5th;



50, s., 10th; 64, w., 21st; 68, w., 22d; 52, sw., 26th; 80, nw., 27th.

Other stations reporting velocities of 50 miles or more per hour are as follows: Cape Mendocino, California, 85, (estimated) se., 20th; Fort Maginnis, Montana, 62, nw., 4th; Sandusky, Ohio, 58, n., 29th; Cape Henry, Virginia, 56, nw., 29th; Buffalo, New York, 56, w., 24th; Cape May, New Jersey, 55, w. 24th; Grand Haven, Michigan, 52, nw., 23d; Indianola, Texas, 52, n. 13th; Kittyhawk, North Carolina, 50, ne., 5th.

#### LOCAL STORMS.

**California:** Cape Mendocino, 20th, a severe southeasterly gale began at 12.30 a. m., and lasted until 6.00 p. m. The wind reached a velocity of seventy-two miles an hour at 10.00 a. m., at which time the anemometer cups were blown away. It is estimated that the wind reached a velocity of eighty five miles an hour when the gale was at its height. A strong southeasterly gale was also reported on the 28th. During the 29th and 30th, a violent storm occurred; the wind blew in hurricane-like gusts, causing the office building to rattle and shake.

**Connecticut:** New Haven, 13th, during a severe gale that occurred in Long Island Sound, two barges and a schooner foundered; the latter vessel had all her sails blown away.

New London, 14th, a heavy gale occurred in Long Island Sound; several vessels sought shelter inside the harbor. On the 25th, during a gale, numerous vessels lost sails and sustained other damage.

**Illinois:** Cairo, 9th, a strong wind, accompanied by hail, (see Hailstorms), occurred about 11.30 p. m. One house was unroofed; other damage was very slight.

**Iowa:** 10th, during a wind storm that occurred at Rippey, Greene county, a house was blown down and completely demolished. The inmates were more or less injured.

**Pennsylvania:** Wellsboro, 25th, a heavy wind storm occurred at 12.30 p. m. Trees and fences were blown down, but no serious damage was done. The storm was accompanied by sleet and hail.

#### VERIFICATIONS.

##### INDICATIONS.

The detailed comparison of the tri-daily indications for November, 1882, with the telegraphic reports for the succeeding twenty-four hours, shows the general average percentage of verifications to be 88.74 per cent. The percentages for the four elements are: Weather, 87.05; direction of the wind, 89.39; temperature, 90.34; barometer, 88.18 per cent. By geographical districts, they are: For New England, 87.2; middle Atlantic states, 88.8; south Atlantic states, 92.2; east Gulf states, 89.8; west Gulf states, 87.2; lower lake region, 89.8; upper lake region, 87.3; Tennessee and the Ohio valley, 90.1; upper Mississippi valley, 88.6; Missouri valley, 86.5; north Pacific coast region, 89.1; middle Pacific coast region, 85.0; south Pacific coast region, 83.9.

There were one hundred and six omissions to predict (forty-five being due to the absence of reports from the Pacific coast), out of 3,690, or 2.87 per cent. Of the 3,584 predictions that have been made, one hundred and thirty-four or 3.74 per cent., are considered to have entirely failed; fifty-three, or 1.48 per cent., were one-fourth verified; four hundred and eight, or 11.38 per cent., were one-half verified; one hundred and five, or 2.93 per cent., were three-fourths verified; 2,884 or 80.47 per cent., were fully verified, so far as can be ascertained from the tri-daily reports.

#### CAUTIONARY SIGNALS.

During November, 1882, one hundred and seventy-three cautionary signals were displayed. Of these, one hundred and fifty-two, or 87.84 per cent., were justified by winds of twenty-five miles per hour, at or within one hundred miles of the station. Of fourteen cautionary off-shore signals displayed, twelve, or 85.7 per cent., were fully justified; fourteen, or 100 per cent., were justified as to velocity; and twelve, or 85.7 per cent., were justified as to direction. Eight "northwest" signals were displayed, and were fully justified. One hundred and

ninety-five signals of all kinds were displayed, and one hundred and seventy-two, or 88.21 per cent., were justified. These do not include signals ordered at sixty-nine display stations, where the velocity only is estimated. Two signals were ordered late.

Eighty-five winds of twenty-five miles or more per hour were reported, for which no signals were ordered; many of these were high local winds, or strong sea-breezes.

#### NAVIGATION.

##### STAGE OF WATER IN RIVERS.

The highest and lowest stages of water observed at the Signal Service stations, during the month of November, 1882, are given in the table on the right side of chart iii., In the first column of this table, the heights of water which have been found dangerous to property are given.

In the Mississippi, the highest water occurred during the latter part of the month, except at Saint Louis, Missouri, where it was observed on the 1st and 2d. The Ohio was highest at Louisville, Kentucky, on the 7th and 8th; at Pittsburg, Pennsylvania, on the 16th; and at Cincinnati, Ohio, on the 22d. The Missouri was highest at Omaha, Nebraska, on the 1st; at Yankton, Dakota, on the 9th and 10th; and at Leavenworth, Kansas, on the 16th and 17th.

##### HIGH TIDES.

Cape Lookout, North Carolina, 21st. Highest tide in the sound ever known at this place. The water rose in the houses on the "Banks." The tides were also high on the 20th, 22d, 28th.

Hatteras, North Carolina, 22d. Very high tide in the sound.

Eastport, Maine, 22d, 23d, 23th.

Punta Rassa, Florida, 20th.

##### LOW TIDES.

New York City, 25th. The strong off-shore winds of the past few days caused unusually low tides in the lower bay and in Princes Bay, and about the shores of Staten Island. Thousands of acres of Princes Bay are entirely bare. Large quantities of clams have been gathered on the south beach; and the oyster beds in Prince's and Raritan Bays are uncovered. The Staten Island ferry-boats experienced much difficulty in making landings. Robbin's Reef, Oyster Island, and Old Tom Reef, in the upper bay were entirely dry.

Indianola, Texas, 21st. Very low tide.

##### ICE IN RIVERS AND HARBORS.

**Penobscot river:** Bangor, Maine, 18th, the dead-water above the mill-dam is frozen over; all mills in the vicinity are closed for the season.

**Hudson river:** Albany, New York, floating ice in the river on 28th, 29th, 30th.

**Erie canal:** Albany, New York, 28th, canal navigation suspended on account of ice.

**Maumee river:** Toledo, Ohio, 30th, floating ice in the river.

**Red river:** Saint Vincent, Minnesota, 11th, navigation suspended on account of ice. Moorhead, Minnesota, 10th, river frozen over; 11th, the steamer "Pluck," arrived on this date, being the last boat of the season. The steamer "Alsop" is beset in the ice twenty miles south of this city. Navigation is closed for the season.

**Winnipeg, Manitoba, 13th:** The Red river is frozen over at this place.

**Missouri river:** Fort Stevenson, Dakota, 23th, river entirely closed. Fort Bennett, Dakota, 9th, ice forming in river; 13th and 23d, floating ice in river. Omaha, Nebraska, 27th, 28th, floating ice in river. Leavenworth, Kansas, 30th, slush ice in river. Fort Hale, Dakota, 29th, river frozen over. Fort Buford, Dakota, 8th, river frozen; navigation closed for season. Fort Yates, Dakota, 8th, last boat of season passed to-day.

**Mississippi river:** Saint Paul, Minnesota, 10th, the steamer "Grand Pacific" left this port to-day for Saint Louis, being the last boat of the season. On the 24th, 25th, and 28th, there was floating ice in the river. On the 25th, the river was frozen along its banks from twenty to fifty feet from the shore. Bur-

lington, Iowa, 22d, the last boat of the season passed this port to-day. Dubuque, Iowa, 21st, the last boat of the season departed for Saint Louis to-day; navigation closed. Keokuk, Iowa, 29th and 30th, floating ice in river. Davenport, Iowa, 22d, navigation closed for the season; the last boat passed downward on this date. The river is open and free from ice.

*Tuscarawas river*: Canal Dover, Ohio, 25th, ice in river reaching only a few feet from the shore. 30th, canal and river frozen over.

*Lake Superior*: Duluth, Minnesota, 21st, bay frozen over on the south side; tugs have difficulty in forcing passage; 30th, the steam barge "Oceola" from Detroit, whose arrival is daily expected, will be the last boat of the season. The barge "Davidson," which left this port on the 27th, was the last departure. A few tugs are still running, but navigation is practically closed for the season.

*Big Horn river*: Fort Custer, Montana, 12th, river frozen over.

*Devil's Lake*: Fort Totten, Dakota, 12th, lake partly frozen over; 23d, lake entirely frozen over.

*Dakota river*: Morriston, Dakota, 10th, river frozen over. Wicklow, Dakota, 25th, ice on lake from five to six inches thick.

*Rock river*: Rockford, Illinois, 27th, floating ice in river.

*Eel river*: Logansport, Indiana, 25th, river partly frozen over.

*Des Moines river*: Humboldt, Iowa, 24th, river frozen over.

#### TEMPERATURE OF WATER.

The temperature of water, as observed in rivers and harbors, at the Signal Service stations, and the average depth at which the observations were taken, are given in the table on the right-hand of chart ii. In the first column of the table, is given, the maximum temperature observed during the month; and in the second column, the minimum temperature observed during the same period.

The table below shows the highest and lowest temperatures of water at the several stations; the range of water temperature; the mean temperature of the air at the station; and the depth of water at which the observations were taken:

Temperature of Water for November, 1882.

STATION.	Temperature at bottom.		Range.	Average depth, feet and inches.	Mean temperature of the air at station.
	Max.	Min.			
Atlantic City, New Jersey	58.6	45.0	13.6	6 11	42.3
Alpena, Michigan	45.7	30.7	15.0	11 0	35.4
Augusta, Georgia	69.0	45.0	24.0	6 8	52.8
Baltimore, Maryland	61.0	44.0	17.0	9 9	44.3
Block Island, Rhode Island	57.5	41.2	16.3	8 6	42.7
Boston, Massachusetts	53.6	37.5	16.1	25 0	37.9
Buffalo, New York	55.0	39.0	16.0	8 0	37.7
Burlington, Vermont	54.0	44.2	9.8	17 0	36.8
Cedar Keys, Florida	76.0	40.0	27.0	8 8	61.7
Charleston, South Carolina	70.9	51.6	19.3	40 2	55.4
Chicago, Illinois	53.5	34.8	18.7	8 2	41.7
Chincoteague, Virginia	66.0	40.0	26.0	6 5	45.5
Cleveland, Ohio	56.3	40.1	16.2	14 0	40.2
Delaware Breakwater, Delaware	61.7	43.5	18.2	7 8	46.5
Detroit, Michigan	52.0	35.0	17.0	23 10	43.0
Duluth, Minnesota	50.0	37.0	13.0	16 0	34.3
Eastport, Maine	49.1	45.1	4.0	17 0	35.7
Escanaba, Michigan	51.4	37.0	14.4	15 0	35.4
Galveston, Texas	77.0	52.0	25.0	14 10	64.1
Grand Haven, Michigan	46.5	31.0	15.5	19 0	40.4
Indianola, Texas	80.5	52.5	28.0	9 6	64.3
Jacksonville, Florida	73.0	60.0	13.0	18 0	60.0
Key West, Florida	81.3	70.0	11.3	14 7	72.9
Mackinac City, Michigan	50.0	37.5	12.5	13 0	37.3
Marquette, Michigan	44.9	35.9	9.0	10 6	35.4
Milwaukee, Wisconsin	49.5	34.6	14.9	8 0	39.8
Mobile, Alabama	73.5	55.0	18.5	14 8	58.5
New Haven, Connecticut	56.7	38.3	18.4	15 2	37.8
New London, Connecticut	61.0	42.0	19.0	12 4	40.0
Newport, Rhode Island	57.7	41.7	16.0	11 3	40.7
New York City	58.5	38.5	20.0	17 2	41.7
Norfolk, Virginia	62.0	45.0	17.0	17 6	40.1
Pensacola, Florida	74.1	56.1	20.0	17 8	59.0
Portland, Maine	50.0	38.5	11.5	19 2	39.6
Portland, Oregon	46.8	39.9	6.9	53 9	43.6
Port Kads, Louisiana	73.0	57.6	15.4	9 2	65.2
Provincetown, Massachusetts	54.0	41.0	13.0	14 0	41.6
Punta Rasa, Florida	79.6	64.6	15.0	11 8	67.1
Sandusky, Ohio	54.6	32.2	22.4	10 0	41.8
Sandy Hook, New Jersey	58.7	47.6	11.1	1 9	43.0
San Francisco, California	55.5	51.8	3.7	32 0	52.5
Savannah, Georgia	67.9	47.6	20.3	13 2	56.3
Smithville, North Carolina	60.0	50.0	10.0	10 0	51.0
Toledo, Ohio	54.5	33.9	20.6	10 7	42.0
Wilmington, North Carolina	63.6	49.0	14.6	13 0	52.2

\* Observations not taken from 6th to 11th inclusive.

The largest monthly ranges are: 28° at Indianola, Texas; 27° at Cedar Keys, Florida; 26° at Chincoteague, Virginia; 25° at Galveston, Texas; 24° at Augusta, Georgia; 22° at Sandusky, Ohio; 20° at Toledo, Ohio; 20° at Savannah, Georgia; 20° at New York City and Pensacola, Florida. The smallest are: 3° at San Francisco, California, 4° at Eastport, Maine; 6° at Portland, Oregon; 9° at Marquette, Michigan; and 9° at Burlington, Vermont.

#### ATMOSPHERIC ELECTRICITY.

##### AUORAS.

Auroral displays were unusually frequent during the month. From the 16th to the 20th, the displays were very brilliant, and were accompanied by the most remarkable electrical disturbances that have been known for many years. Its effects upon the telegraph lines were generally felt throughout the United States. Long circuits were operated without the aid of batteries, and telegraphic and telephonic communication were seriously interrupted during its continuance. This auroral display and magnetic storm was observed and its influence felt throughout the British Isles, in British America, and in nearly all parts of the United States.

The following extract relating to this display is taken from "Nature" (a scientific journal published in London), of November 23, 1882:

"The telegraphic system of this country, has, since Friday morning last, been disturbed in a way that far exceeds anything of the kind that has ever happened before. Very powerful electric currents have been swaying backwards and forward through the crust of the earth, taking all telegraphic circuits in the progress, and entirely stopping communication. Communication has been maintained only, where it was possible to loop together two wires, so as to avoid the use of the earth altogether. The electric storm commenced on Thursday, but it reached its climax on Friday morning (November, 17th), between 10.00 and 11.00 a. m. The currents measured over fifty milliamperes, which is five times greater than the ordinary working currents. They have repeated themselves at intervals ever since, but have scarcely attained such an intensity as on Friday morning.

"Mr. Preece, whose experience in examining earth currents now extends over a period of thirty years, asserts that this storm was the most terrific he has ever observed. It was characterized on Friday by a rapid succession of alternate waves of great strength."

The following communication by Mr. W. H. M. Christie, of the Royal Observatory, Greenwich, of date November 20th, 1882, is also taken from "Nature":

"A remarkable magnetic storm, preceded by several days of considerable magnetic disturbance, was observed here on November 17th. It commenced suddenly—November 16, 22 h. 15 m. Greenwich mean time—with a great decrease in all the magnetic elements, the declination being diminished by more than 1°, the longitudinal force by more than 1-100th part, and the vertical force by nearly 1-100th part. From 4 h. to 7 h., and also from 11 h. to 17 h., the motions were large and violent, the range exceeding 2° for the declination and 1-50th part for the horizontal and vertical force. Earth-current disturbances were also recorded, corresponding both in time and magnitude with the magnetic changes.

"In the evening, as soon as it was dark, a brilliant aurora was seen, commencing with a bright glow of red light extending from the north and west beyond the zenith, interspersed with pale green phosphorescent light and streamers. At 6 h. 4 m. a very brilliant streak of greenish light about 20° long appeared in the east-northeast, and, rising slowly, passed nearly along a parallel of declination, a little above the moon, disappearing at 6 h. 5 m. 59 s. in the west, about two minutes after it was first seen. The whole aurora had faded away by about 7 h., but it burst out again at 11 h. 45 m., when an auroral arch, with brilliant streamers reaching nearly to the zenith, was seen from north-northeast to northwest. It faded away about 12 h. 10 m.



"A remarkable sun spot, visible to the naked eye, was seen on the sun on November 17th and following days, photographs being obtained on November 18th, 19th, and 20th. Its dimensions on November 18th, when it was near the central meridian, were: Length, 194''; breadth, 130''; area of umbra, 735; of whole spot, 2470 (expressed in millionths of the sun's visible surface), and its position. Heliographic latitude, 19° N.; longitude, 121°. Its spectrum showed C, F, D3, and the D lines reversed over the principle nucleus, C and F being extremely bright, and D1, D2, D3 doubly reversed. It slightly diminished in size on the two following days. This is the largest spot that has yet been photographed at Greenwich.

"Another very active magnetic disturbance commenced on November 19th, soon after midnight, and at noon to-day (November 20th) it is still in progress, all the elements being greatly disturbed."

Professor Charles Carpmal, Superintendent of the Meteorological Service of the Dominion of Canada, in the "Canadian Weather Review," for November, 1882, reports as follows:

"The number of auroras, as in the previous month, seems to have attained a much larger proportion than is usual for November, eight having been recorded at Toronto. This number has only been equalled once in thirty years (1860). The same fact appears to hold good throughout Canada. Some of these were very brilliant, especially that on the 17th, which appears to have been observed all over Canada, where the night was favorable."

Some of the most interesting reports that have been received concerning this phenomenon in the United States, are given below. Cloudiness, which prevailed to a large extent, interfered in great measure with the observations of the aurora.

Eastport, Maine: 16th, a faint straw-colored auroral light was observed between 7.00 and 11.00 p. m. 17th, auroral light observed from 7.00 p. m. to the early morning of the 18th. During the afternoon, the hard rubber in the lightning-arrester was burned out. Waves of whitish light shot upward from all parts of the horizon to the zenith. 18th, auroral light, similar to that observed on the night of 17th-18th, was visible from 7.00 p. m. to midnight; it consisted of waves of whitish light, shooting up from all quarters to the zenith.

Boston, Massachusetts: 17th, one of the severest electric storms ever experienced at this place began during the early morning and continued until late in the evening. Telegraphic communication between Boston and New York City was entirely suspended for more than three hours. 19th, a very brilliant aurora was observed from 10.40 p. m. till daybreak of the 20th. The light covered 80° of the northern horizon, and rose to an altitude of 90°, with streamers reaching entirely across the sky. 20th, aurora was visible from 7.15 to 8.00 p. m.; it was formed of slender luminous beams, extending from north to northeast, and to an altitude of 20°.

New Haven, Connecticut: 17th, at 5.36 a. m., nearly one hundred annunciators at the telephone office dropped instantaneously. This was repeated at irregular intervals throughout the day and night. The telegraph wires worked badly, showing the existence of an electric storm. The falling snow and clouds prevented any auroral observations. 18th, the snow storm continued until 2.00 a. m. At 3.00 a. m., when the clouds cleared away, a brilliant auroral display was visible in the northern sky. Columns of light of a yellowish grey color, shot upward, like rockets, to the north star. These were alternated with wave-like pulsations of the entire mass. The display continued until daybreak. At 6.30 p. m., delicate auroral streamers of brilliant green color shot upward from the horizon in the northwestern sky, to an altitude of 40°. They remained steady for a few minutes and disappeared temporarily, reappearing again to the east of north. These soon disappeared, leaving a dim slaty glow along the northern horizon. At 7.00 p. m., the auroral light gradually merged into the moonlight; 19th. A dim auroral light appeared in the north at 8.00 p. m., and a double arch formed at 8.45 p. m. This rose slowly and formed into a brilliant single arch, 20° in height, with a segment beneath of

inky blackness. The band and dark segment merged into a dim radiance at 10.30 p. m. At 11.00 p. m., an arch, 25° in height, formed and immediately streamers shot upward nearly to the zenith; at this time, there was no dark segment. At 11.15 p. m., the whole northern sky, from east to west, was a mass of quivering filaments of steel-colored light. At the zenith a heavy mass appeared for a short time, while blood-red patches constantly shifted from one part of the sky to the other. At midnight the arch resembled the bottom of a silvery curtain hanging in folds. The display continued until daylight of the 20th.

New York City: 17th, no aurora was observed, but a remarkable electrical storm began at 5.00 a. m., and increased in intensity until 9.00 a. m., when the transmission of signals over telegraph wires having earth currents, became impossible. Metallic circuits worked perfectly, and by this means business was transacted to some extent over isolated lines. The disturbance continued until 1.50 p. m., when the working of the wires was resumed. The telegraph officials pronounce this disturbance to have continued longer and to have been severer than any other ever experienced here. At the office of the Direct Cable Company, messages could not be transmitted except when relieved of the ground wires, and placed in metallic circuit. There was the same trouble at the offices of the Mexican and Cuban cables.

Washington, District of Columbia: 18th, a faint auroral light was visible in the northern sky from 1.20 a. m. till daybreak. 19th, faint auroral light in northern sky at 10.30 p. m., reaching an altitude of 15°. The display continued until 12.30 a. m. of the 20th, when the sky became obscured by clouds.

Albany, New York: 16th, the effects of the magnetic storm was first felt here at 8.00 p. m., and gradually increased until noon of the 17th, when telegraphic communication south and west was wholly suspended. The current seemed to be strongest from the east, the wires connecting with Boston, being the first to become unserviceable. The switch-board was several times ignited. The wire from Albany to Utica was worked without battery. The telegraph companies were compelled to use metallic circuits; and nearly all business was transacted during the afternoon of the 17th by this means. 19th, at 9.00 p. m., an aurora was observed, extending from 90° to 270° azimuth, and to the zenith. Beams of bright light were continually shooting upwards from the horizon, changing in color from red to yellow. At 11.00 p. m., a perfect corona was formed, with its centre about 5° south of the zenith; it lasted until 11.50 p. m. Immediately after the corona disappeared an arch formed with an altitude of 60°, along this, "merry dancers" travelled with great rapidity. Soon after this the arch broke up, but the display continued in the form of a curtain of yellow light, until 12.10 a. m., when it again assumed the form of an arch. The display ended at 12.30 a. m. of the 20th.

Chicago, Illinois: 17th, a remarkable intensity of atmospheric electricity was reported by the various telegraph companies in this city. The switch-boards were burned and wires were worked with detached batteries. Evidences of an auroral display were observed at intervals during the evening, through occasional openings in the clouds.

Buffalo, New York: 17th, the clouds began to break away at 9.00 p. m., when an aurora was observed. Later, it became one of the most brilliant displays ever witnessed at this station. At 10.30 p. m., it had become clear, and the aurora was visible in all parts of the sky. Great beams of bright whitish light, resembling cirrus clouds, extended from all points along the horizon, and converged towards "Ursa Minor," forming a crown of white light around the constellation. The display continued with great brilliancy until 3.00 a. m. of the 18th, when a few beams only were visible in the north, there extended to an altitude of 40°. The appearance of this aurora was anticipated from the difficulty experienced on the telegraph lines during the preceding day. During the entire day and night the wires were worked only with the greatest difficulty.

**Saint Paul, Minnesota:** 17th, all of the telegraph lines running from this point eastward and over the northwest were much deranged, and worked badly from early morning to midnight. At 5.00 p. m., a dark, slate-colored segment was observed along the northern horizon, extending from  $165^{\circ}$  to  $210^{\circ}$  azimuth, and to an altitude of  $20^{\circ}$ . At 5.25 p. m., numerous beams shot upward from the segment toward the zenith, ranging in altitude from  $45^{\circ}$  to  $75^{\circ}$ . These beams, as well as the space over which they spread, varied from pale straw-color to a rosy hue, with occasional patches of deep red. At their first appearance, the beams did not extend over more than  $40^{\circ}$  of the northern horizon, but they advanced quickly, both east and west, and at 5.50 p. m., the whole northern heavens were covered with diffuse light, and with beams varying from straw-color to a rosy hue. The display continued without any marked change until 8.00 p. m., when the aurora showed great activity; and at 8.03 p. m., the whole sky, with the exception of a clear segment from  $25^{\circ}$  to  $55^{\circ}$  azimuth and of  $15^{\circ}$  altitude, was covered with beams and with auroral features of infinite varieties, colors varying from light slate to a deep red. At this time a complete corona was formed at a point  $5^{\circ}$  south and  $10^{\circ}$  east of the zenith. At 8.20 p. m., the luminous arches, on which the crown rested, and the corona began to fade, and at 8.23 p. m., only a faint trace of the aurora could be seen on the northern horizon. From 8.30 to 10.20 p. m., there was a hazy appearance in the north, varying from light to dense, and the remainder of the sky was perfectly clear, all traces of the aurora having disappeared. At 10.35 p. m., it again appeared, resembling the former display in all respects, except that the corona was, at this time, formed about  $5^{\circ}$  north of the zenith. At 10.45 p. m., the display disappeared, leaving the dark segment with faint traces of the auroral light until 11.30 p. m., when clouds formed. The aurora was reported to have been observed again in the form of luminous beams and pale diffuse light along the northern horizon until 2.30 a. m. of the 18th. On the 19th, at 6.25 p. m., a diffuse glare, emanating from a hazy segment, was observed in the north. At 6.40 p. m., numerous beams and rectangular-shaped belts, from  $0^{\circ}$   $30'$  to  $2^{\circ}$  in width, shot upward toward the zenith to an altitude of  $20^{\circ}$  to  $30^{\circ}$ . The display continued until 11.40 p. m., when it became obscured.

**Portland, Oregon:** 17th, a brilliant auroral display was observed during the early morning. When first seen, at 3.50 a. m., it resembled the morning dawn. A few minutes later, a dark bank of a slatish color appeared; this formed a segment of a circle about  $10^{\circ}$  above the horizon and extending across the northern sky from east to northwest. Above this dark bank appeared an arc of delicate green, gradually fading to a bright white at the upper edge. This arc soon changed its color to a pale yellow or straw, and beautiful streamers of pale green at the base, changing to light pink at the centre, and to bright pink at the upper ends, shot from it. These constantly moved upward and downward and from side to side, rapidly changing in color. The dark base remained almost stationary, having only a slight motion from northwest to east, while rays of light shot upward from it to a height of  $90^{\circ}$  or more. The surrounding sky exhibited a great variety of tints. These colors varied in position and intensity. The display ended during the early morning of the 19th. The observer at Portland reports that this display was far more brilliant than any ever witnessed by him while he was stationed on the summit of Mount Washington, New Hampshire. During the evening of the 19th, there was a similar display; this continued all night, but owing to the increased light of the moon, the colors were not so well-defined.

**Salt Lake City, Utah:** 18th, at 6.08 p. m., an aurora was observed in the north, covering about  $90^{\circ}$  of the horizon and extending to an altitude of  $20^{\circ}$ . The mountains north of this city interfered with the observation. The color was reddish and resembled the reflection from an immense fire. A few short streamers appeared, but they remained visible a short time only. The display, which continued until 9.10 p. m., was the first aurora seen here for many years.

**Los Angeles, California:** 17th, an aurora appeared at 7.10 p. m. as a mass of red light, it resembled the reflection of a large fire, and it moved from a point about  $15^{\circ}$  east of "Ursa Major" to a point  $10^{\circ}$  west of the same. At 7.30 p. m., the display was very brilliant. This phenomenon being of unusual occurrence in this latitude, a good deal of alarm was caused among the inhabitants, who supposed that an extensive fire had broken out in the town.

**Yuma, Arizona:** 17th, a fine auroral display was observed between 6.30 and 7.30 p. m. Beams rose to an altitude of from  $20^{\circ}$  to  $40^{\circ}$ , and were of deep red color. The display was confined to the eastern half of the northern sky. The aurora is seldom seen in this latitude.

**San Diego, California:** 17th, a brilliant aurora was observed here this evening, consisting of columns of light shooting upward from a point a little east of north, to an altitude of  $20^{\circ}$ . No arch was visible, but the columns blended together forming a cloud of deep red color, which varied in intensity until 7.20 p. m., when it faded from view. This is the first aurora that has been witnessed here since the establishment of the signal office. 20th, a faint aurora, consisting of two luminous beams rising to a height of  $20^{\circ}$ , was observed at 4.20 a. m. The display lasted till daybreak. At 12.20 p. m., the clouds appeared electrified in an unusual manner. They were of the cirrus class, and were formed in broken lines in a nearly parallel direction from west to east.

**Galveston, Texas:** 17th, from 10.00 to 11.00 p. m., the sky in the north and northeast became suffused with a brilliant red. This was the first aurora that has been observed at this place since the establishment of the signal office in April, 1871.

**Punta Rassa, Florida:** 17th, from 11.15 p. m. to midnight, a well-defined auroral display was observed. It was first noticed as a pale luminous light, in the north, of  $10^{\circ}$  or  $12^{\circ}$  altitude, resting upon a bank of haze. Later, the light assumed a reddish tinge, gradually deepening in color and extending upward until it presented the appearance of an irregularly shaped dome. This dome waxed and waned both in intensity of color and in dimensions; sometimes it almost faded away, and then reappeared to the westward and eastward of its original position; occasionally, there were two of these domes visible at the same time. A few faint streamers were seen at the beginning of the display, having a slight lateral motion. Throughout the day, the operators of the International Ocean Telegraph company found it difficult to work the cables, connecting this place with Key West, Florida, and Havana, Cuba. The disturbance was felt at the telegraph offices at both Key West and Havana. The effect upon the land lines was not perceptible at this station.

**Nashville, Tennessee:** 17th, from 1.30 to 4.30 a. m., a brilliant auroral display was observed; it consisted of a deep reddish light in the northern sky. Cloudiness interfered to some extent with the observation. The Saint Louis and Nashville telegraphic circuit was worked without battery, as were also the wires from this city to Lebanon, Tennessee, which are sixty miles apart. 19th, a break in the clouds on the northern horizon, at 9.40 p. m., revealed an aurora of exceptional brilliancy. Numerous beams of  $5^{\circ}$  to  $10^{\circ}$  in width were observed, but their altitude could not be determined on account of cloudiness. The sky became totally obscured at 10.30 p. m. Numerous other auroral displays occurred during the month, none of which, however, exhibited and unusual characteristics. They were observed on the following dates: 2d, 5th, 10th to 14th.

#### THUNDER-STORMS.

Thunder-storms were reported in the various districts on the following dates:

*South Atlantic states:* 1st, 2d, 22d, 23d.

*Florida peninsula:* 1st, 2d, 3d, 27th.

*East Gulf states:* 1st, 2d, 3d, 6th, 12th.

*West Gulf states:* 1st, 2d, 3d, 5th, 6th, 8th to 12th, 16th, 26th.

*Tennessee:* 1st, 2d, 9th to 12th.

*Ohio valley:* 1st, 5th, 8th, 9th, 10th.



*Lower lake region:* 11th, 24th.

*Upper lake region:* 10th, 11th.

*Upper Mississippi valley:* 1st, 4th, 5th, 8th to 11th.

*Missouri valley:* 1st, 4th, 5th, 7th to 11th, 16th, 25th, 26th.

Thunder-storms were also reported from the following stations, not included in the districts named above: Burlington, Vermont, 11th; Bangor, Maine, 24th; Brackettville, Texas, 26th; Brownsville, Texas, 12th; Cheyenne, Wyoming, 10th, 11th, 15th, 16th; Fort Supply, Indian Territory, 8th, 10th; West Las Animas, Colorado, 10th; Coleman City, Texas, 16th; Fort Davis, Texas, 15th, 16th; Fort Cummings, New Mexico, 7th, 8th; Santa Fé, New Mexico, 8th, 9th; Wellington, Kansas, 8th, 11th; Yates Centre, Kansas, 1st, 4th, 7th to 10th; Pretty Prairie, Kansas, 8th, 10th; Orono, Maine, 24th; Johnstown, Virginia, 1st.

During thunder-storms, the following instances of damage by lightning have occurred:

Buffalo, New York, 11th: An extensive malt house at Black Rock, was struck by lightning and damaged.

Iron-ton, Missouri, 10th: A tramp who had taken shelter under a sand-shed in Arcadia, was injured by lightning; his coat-tail was torn into shreds and his trousers were ripped to the bottom. A large red mark was left on his thigh, and a red streak down his leg.

Lewiston, Maine, 24th: During a hail storm on the afternoon of this date, a barn in Webster county, containing hay, was struck by lightning and set on fire.

Humboldt, Iowa, 11th: A span of horses were struck by lightning, eight miles south of station.

#### OPTICAL PHENOMENA.

##### SOLAR HALOS.

Solar halos have been observed in the various districts, on the following dates:

*New England:* 3d, 7th, 20th, 21st, 25th, 26th, 28th.

*Middle Atlantic States:* 9th, 15th, 21st, 26th, 27th, 28th.

*South Atlantic States:* 12th, 13th, 19th, 20th, 25th, 27th.

*East Gulf States:* 5th, 6th, 9th, 16th, 17th, 18th, 22d, 23d.

*West Gulf States:* 14th, 18th, 21st, 22d, 23d.

*Ohio Valley and Tennessee:* 5th, 8th, 9th, 11th, 16th, 18th, 19th, 20th, 22d to 25th, 27th, 30th.

*Upper Mississippi Valley:* 4th, 8th, 15th, 24th, 27th to 29th.

*Missouri Valley:* 4th, 7th, 8th, 9th, 11th, 13th, 15th, 21st, 23d, 24th, 26th, 30th.

Solar halos were also reported from the following stations, not included in the districts named above: Manitowoc, Wisconsin, 8th; Alpena, Michigan, 1st; New Riegel, Ohio, 15th; Detroit, Michigan, 25th; Toledo, Ohio, 5th; Prescott, Arizona, 21st, 23d; Salt Lake City, Utah, 2d, 23d, 29th, 30th; Colfax, Washington Territory, 8th; Lewiston, Idaho, 2d, 28th; Albany, Oregon, 6th, 7th; San Diego, California, 2d, 3d, 12th; San Francisco, California, 6th, 11th, 14th, 22d, 27th; Carson City, Nevada, 6th, 22d, 25th.

A very remarkable solar halo was observed at 10.00 a. m. of the 7th, on board the s. s. "Ptolemy," in latitude N. 19° 51', longitude W. 37° 21'. The phenomenon preceded a period of tempestuous weather and contrary winds.

##### LUNAR HALOS.

Lunar halos have been observed in the various districts on the following dates:

*New England:* 20th to 23d, 25th to 28th.

*Middle Atlantic states:* 16th, 18th to 25th, 28th.

*South Atlantic states:* 19th, 22d, 23d, 27th.

*East Gulf states:* 2d, 18th, 21st to 24th.

*West Gulf states:* 15th, 17th, 20th to 24th.

*Rio Grande valley:* 14th, 22d, 23d.

*Ohio valley and Tennessee:* 17th to 21st, 23d to 29th.

*Lower lake region:* 3d, 24th to 28th.

*Upper lake region:* 17th, 19th, 20th, 23d, 25th, 29th, 30th.

*Extreme northwest:* 8th, 21st, 22d, 24th, 29th.

*Upper Mississippi valley:* 15th, 20th, 21st, 22d, 24th to 28th, 30th.

*Missouri valley:* 1st, 3d, 18th to 27th, 30th.

*Northern slope:* 17th, 18th, 20th, 25th, 26th, 28th.

*Southern plateau:* 3d, 5th, 20th to 23d, 26th, 28th, 30th.

*Middle plateau:* 2d, 7th, 19th, 23d, 25th, 26th, 28th, 29th, 30th.

*Northern plateau:* 1st, 17th, 20th to 22d, 24th, 26th to 28th.

*North Pacific coast region:* 18th, 19th, 22d to 24th, 26th, 27th, 29th.

*California:* 1st, 5th, 18th, 22d to 25th, 28th.

Lunar halos were also reported from the following stations, not included in the districts named above:

Cedar Keys, Florida, 17th.

Punta Rassa, Florida, 29th.

North Platte, Nebraska, 26th.

Clay Centre, Kansas, 21st, 26th.

Pretty Prairie, Kansas, 24th.

Wellington, Kansas, 23d.

Yates Centre, Kansas, 21st, 26th.

Fort Concho, Texas, 6th, 30th.

Coleman City, Texas, 22d.

##### MIRAGE.

Northport, Michigan: 1st, a mirage was observed here on this date from 9.00 a. m. to 3.30 p. m.; it showed the beach on the opposite side of Traverse Bay so plainly that cattle were seen walking along the shore of Antrim county. The distance across the bay at this place is twelve miles.

Cape Lookout, North Carolina, 23d.

Indianola, Texas, 14th, 20th, 27th to 30th.

Rapid City, Dakota, 29th.

Salina, Kansas, 6th.

Pretty Prairie, Kansas, 6th.

#### MISCELLANEOUS PHENOMENA.

##### SUNSETS.

The characteristics of the sky, as indicative of fair or foul weather for the twenty-four hours succeeding each observation taken at sunset, have been noted at all Signal Service stations. Reports from one hundred and ninety-one stations show 5,696 observations to have been made, of which forty-two were reported doubtful; of the remainder, 5,654, there were 4,869 or 86.3 per cent., followed by the expected weather.

##### SUN SPOTS.

The following record of observations has been forwarded by Mr. A. S. Bender, of Sacramento, California:

DATE— Nov., 1882.	No. of new		Disappeared by rotation		Reappeared by rotation		Total No. of		Remarks.
	Gr'ps	Spots	Gr'ps	Spots	Gr'ps	Spots	Gr'ps	Spots	
3, 4 p. m.	1	1	1	1	.....	.....	6	20†	New group came in by rotation but not reappeared.
4, 4 p. m.	1	10	.....	.....	.....	10	7	40†	
5, 4 p. m.	.....	10	2	15†	.....	.....	5	30†	
10, 4 p. m.	1	1	3	20†	.....	.....	2	10†	Some spots very faint.
11, 4 p. m.	1	1	.....	.....	.....	.....	3	10†	
13, 4 p. m.	1	10	.....	.....	.....	.....	4	20†	One spot in new group very large.
14, 4 p. m.	1	1	1	1	.....	.....	4	20†	
15, 4 p. m.	.....	.....	1	10†	.....	.....	3	10†	Group of 13th seems now to be four large spots.
16, 4.15 p. m.	.....	.....	.....	.....	1	1	4	20†	Number of spots in large group increased.
17, 4.00 p. m.	1	2	1	1	.....	.....	4	15†	Number of spots in large group changing; two very large.
18, 2.45 p. m.	.....	.....	.....	.....	.....	.....	4	10†	Number of spots in large group changing; five very large. The large group visible as one spot to naked eye.
19, 4 p. m.	.....	.....	.....	.....	1	3	5	15†	
20, 4 p. m.	.....	.....	2	5	.....	.....	3	10†	
22, 4 p. m.	2	5	.....	.....	.....	.....	5	15†	New group came in by rotation but not reappeared.
23, 3 p. m.	1	1	.....	.....	.....	.....	6	15†	Do.
26, 3 p. m.	.....	10	.....	.....	.....	.....	6	25†	Number of spots increased.
27, 1.30 p. m.	1	1	.....	.....	.....	.....	7	45†	A large number of new spots visible in groups already noted.
29, 2.45 p. m.	.....	.....	.....	.....	.....	.....	7	60	Do.
30, 4 p. m.	.....	.....	.....	.....	.....	.....	.....	.....	Atmosphere very hazy.

† Estimated.

Saint Louis, Missouri, 15th: A large spot, visible to the naked eye, was observed on the sun's disc on this date.

Boisé City, Idaho, 15th: A large sun spot was observed with the naked eye.

Wabash, Indiana, 21st: Numerous sun spots observed, some very large.

North Lewisburg, Ohio: Sun spots were seen on all clear days during the month. They were most numerous on the 2d and 25th; largest from 14th to 23d, being plainly visible to the naked eye.

Westerville, Ohio: 15th, very large spot observed on the sun's disc. On the 18th, the spot was more developed, and resembled a group of large spots.

Springfield, Massachusetts, 23d. Large sun spot, visible to the naked eye.

#### METEORS.

Fort Scott, Kansas, 20th: An unusually brilliant meteor was observed in the northeastern sky at 8.00 p. m. When first seen it was about 30° above the horizon. It pursued a downward course, apparently increasing in size, and before disappearing, it burst into many fragments.

Portland, Oregon, 24th: Very brilliant meteor observed at 5.56 p. m. When first seen, it was about 80° above the horizon, and resembled a ball of fire.

Palestine, Texas, 29th: Twenty-one shooting stars were counted between 9.30 and 9.45 p. m. of this date.

New London, Connecticut, 13th.

Portland, Maine, 15th.

Bangor Maine, 5th.

New York City, 3d.

Augusta, Georgia, 1st, 12th.

Indianapolis, Indiana, 21st.

Toledo, Ohio, 13th.

Yuma, Arizona, 1st, 4th, 8th to 10th, 12th to 14th, 17th, 19th.

Visalia, California, 26th.

Alexandria, Dakota, 10th.

Wicklów, Dakota, 7th, 8th, 12th, 13th, 14th, 17th, 18th, 19th.

Anna, Illinois, 15th.

Morrison, Illinois, 7th, 14th.

Charleston, Illinois, 3d, 30th.

Vevay, Indiana, 1st, 22d, 27th.

Muscatine, Iowa, 4th.

Cedar Rapids, Iowa, 1st.

Woodstock, Maryland, 2d, 5th, 10th, 15th.

Little Rock, Arkansas, 6th.

Yates Centre, Kansas, 6th.

Clay Centre, Kansas, 5th.

Fort Scott, Kansas, 3d, 5th, 6th, 10th.

Cornish Maine, 6th.

Dexter, Maine, 3d, 5th.

Sandy Springs, Maryland, 26th.

Williamstown, Massachusetts, 10th.

Rowe, Massachusetts, 1st, 2d, 5th, 6th.

Protem, Missouri, 3d, 4th, 5th, 12th.

Clear Creek, Nebraska, 7th, 9th.

Freehold, New Jersey, 5th, 14th.

Moorestown, New Jersey, 22d, 27th.

Canal Dover, Ohio, 3d.

Westerville, Ohio, 13th.

Fallsington, Pennsylvania, 30th.

Stateburg, South Carolina, 9th.

Ashwood, Tennessee, 3d.

Snowville, Virginia, 10th.

#### EARTHQUAKES.

Saint Louis, Missouri, 14th: Three distinct shocks of earthquake were felt in the western part of the city at 9.14 p. m. The same shock was also reported to have been felt at Saint Charles, Missouri, at 9.21 p. m., and at Collinsville, Illinois, at 9.17 p. m.

Cheyenne, Wyoming, 7th: An earthquake shock was felt here at 6.20 p. m., it was accompanied by a rumbling sound.

The shock was sufficient to shake the walls and floors of buildings; the vibration came from the west.

Denver, Colorado, 7th: A light shock of earthquake occurred at this place at 6.20 p. m. The vibration came from the southwest.

Salt Lake City, Utah, 7th: A slight shock of earthquake occurred at 6.00 p. m.; vibration, from east to west; duration ten seconds.

Fort Washakie, Wyoming, 7th: Three distinct shocks of earthquake were felt here at 6.00 p. m., each of which were from two to three seconds duration. Lamps and chandeliers were observed to vibrate from west to east.

Salina, Kansas, 7th: At 6.55 p. m., an earthquake shock occurred; it lasted six seconds. The vibration was from southeast to northwest, and was sufficient to shake chandeliers, etc.

#### SAND-STORMS.

Camp Thomas, Arizona, 2d, 6th, 10th, 14th.

Apache Pass, Arizona, 9th.

#### POLAR BANDS.

Nashville, Tennessee, 19th, 24th, 25th.

Dubuque, Iowa, 4th.

Wickenburg, Arizona, 19th.

Los Angeles, California, 3d, 9th, 20th, 29th.

Fort Meade, Dakota, 11th.

Yates Centre, Kansas, 12th, 26th.

Gardiner, Maine, 26th.

Fayette, Mississippi, 7th.

Protem, Missouri, 20th.

Clear Creek, Nebraska, 8th, 15th, 18th.

Freehold, New Jersey, 3d.

Vineland, New Jersey, 3d.

New Riegel, Ohio, 3d, 4th, 11th, 25th.

Woodstock, Vermont, 28th.

Wytheville, Virginia, 11th, 19th, 20th.

#### ZODIACAL LIGHT.

Palestine, Texas, 7th, 13th, 14th, 15th, 28th, 29th, 30th.

Nashville, Tennessee, 4th, 6th.

Visalia, California, 17th.

Cambridge, Massachusetts.—Observed 2d, 4th, 8th, 9th, 11th, 27th, 30th; suspected 14th, 15th.

Somerset, Massachusetts, 27th, 30th.

New Riegel, Ohio, 8th, 14th, 15th, 18th, 20th, 21st.

#### PRAIRIE AND FOREST FIRES.

New York City, 2d: Extensive forest fires are reported to be burning in the Catskill mountains near Germantown.

Fort Sill, Indian Territory, 6th, 8th, 29th.

Saint Vincent, Minnesota, 21st, 22d.

North Platte, Nebraska, 15th.

Wicklów, Dakota, 1st to 4th, 6th, 7th, 9th, 10th, 11th.

Humboldt, Iowa, 15th.

Creswell, Kansas, 11th.

#### MIGRATION OF BIRDS.

*Geese flying south:* Yuma, Arizona, 11th; Fort Smith, Arkansas, 2d; Little Rock, Arkansas, 10th; San Diego, California, 1st; Tobacco Garden, Dakota, 4th; Yankton, Dakota, 15th; Cairo, Illinois, 1st, 2d, 5th, 7th, 24th, 26th, 27th; Champaign, Illinois, 10th; Charleston, Illinois, 1st 2d, 3d; Elmira, Illinois, 4th, 13th; Springfield, Illinois, 27th; Laconia, Indiana, 11th; Fort Sill, Indian Territory, 12th; Indianola, Iowa, 12th; Creswell, Kansas, 1st, 8th; Fort Scott, Kansas, 3d, 11th; Independence, Kansas, 1st, 2d, 3d; Yates Centre, Kansas, 2d; Shreveport, Louisiana, 8th; Williamstown, Massachusetts, 17th, 18th; Northport, Michigan, 2d; Saint Vincent, Minnesota, 8th, 9th; Protem, Missouri, 2d; Clear Creek, Nebraska, 1st, 5th; Cape May, New Jersey, 12th; Freehold, New Jersey, 3d; Moorestown, New Jersey, 2d; Ithaca, New York, 16th; Palermo, New York, 14th; Portland, Oregon, 27th; Roseburg, Oregon, 6th; Williamsport, Pennsylvania, 2d; Block Island, Rhode Island, 20th, 21st; Ashwood, Tennessee, 2d; Brownsville, Texas, 12th; Coleman City, Texas, 5th, 11th; Denison, Texas,



1st; Eagle Pass, Texas, 23d; Indianola, Texas, 7th, 8th, 27th; Palestine, Texas, 1st, 2d, 12th, 17th; Uvalde, Texas, 11th; Charlotte, Vermont, 17th; Johnstown, Virginia 2d; Spokane, Falls, Washington Territory, 9th; Morgantown, West Virginia, 13th, 14th, 27th.

*Ducks flying south:* Little Rock, Arkansas, 10th; Macon, Georgia, 3d, 4th, 15th; Charleston, Illinois, 12th, 26th; Davenport, Iowa, 13th, 15th; Dubuque, Iowa, 11th, 12th; Muscatine, Iowa, 12th; Fort Scott, Kansas, 1st, 2d, 10th; Yates

Centre, Kansas, 1st, 2d, 5th, 16th; Northport, Michigan, 2d; Clear Creek, Nebraska, 1st; Bordentown, New Jersey, 24th; Ithaca, New York, 16th; Narragansett Pier, Rhode Island, 11th; Coleman City, Texas, 25th; Indianola, Texas, 7th, 8th, 27th; Morgantown, West Virginia, 14th.

*Brents flying south:* Independence, Iowa, 8th; Dyberry, Pennsylvania, 14th.

*Cranes flying south:* Charleston, Illinois, 20th; Yates Centre, Kansas, 2d.

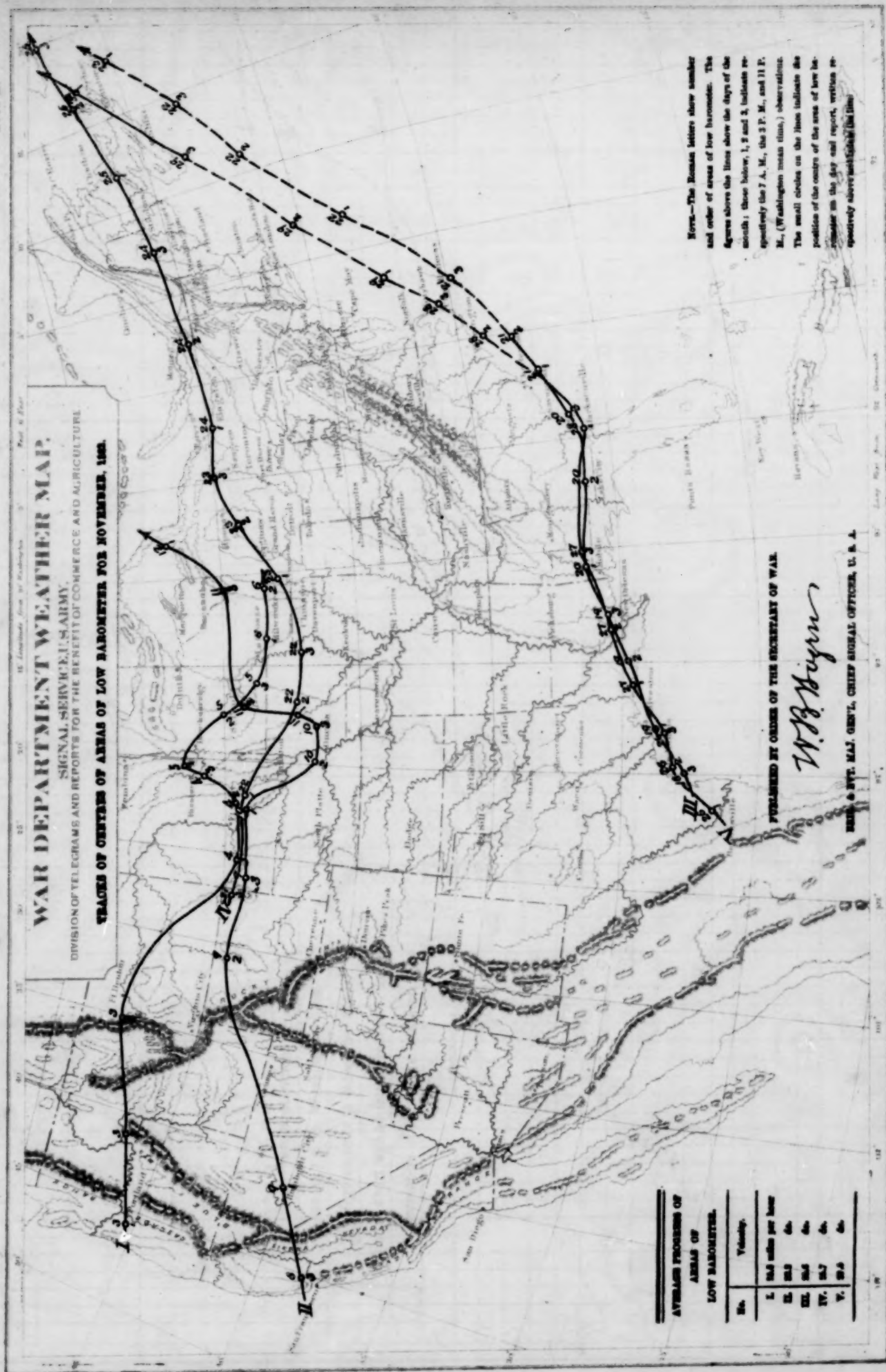




# WAR DEPARTMENT WEATHER MAP.

SIGNAL SERVICE, U. S. ARMY.  
DIVISION OF TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE.

TRACES OF CENTERS OF AREAS OF LOW BAROMETER FOR NOVEMBER, 1922.



Note.—The Roman letters show number and order of areas of low barometer. The figures above the lines show the days of the month; those below, 1, 2 and 3, indicate respectively the 7 A. M., the 3 P. M., and 11 P. M. (Washington mean time) observations. The small circles on the lines indicate the position of the centers of the areas of low barometer on the day and report, written respectively above and below the line.

PUBLISHED BY ORDER OF THE SECRETARY OF WAR.

*W. B. Smith*

MAJ. GEN'L. CHIEF SIGNAL OFFICER, U. S. A.

## AVERAGE PROGRESS OF AREAS OF LOW BAROMETER.

No.	Velocity.
I.	34.5 miles per hour
II.	32.5 " "
III.	30.5 " "
IV.	28.5 " "
V.	26.5 " "

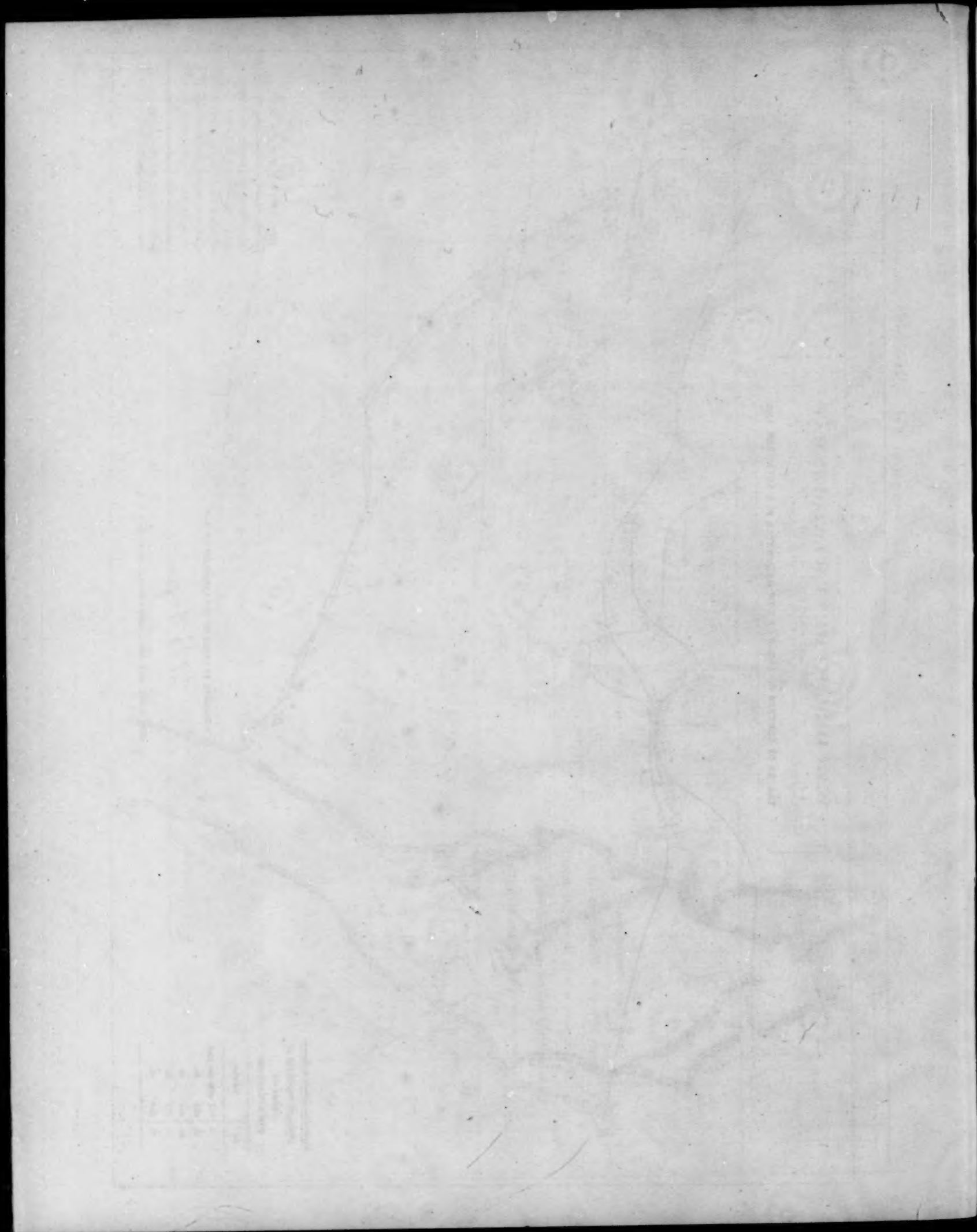
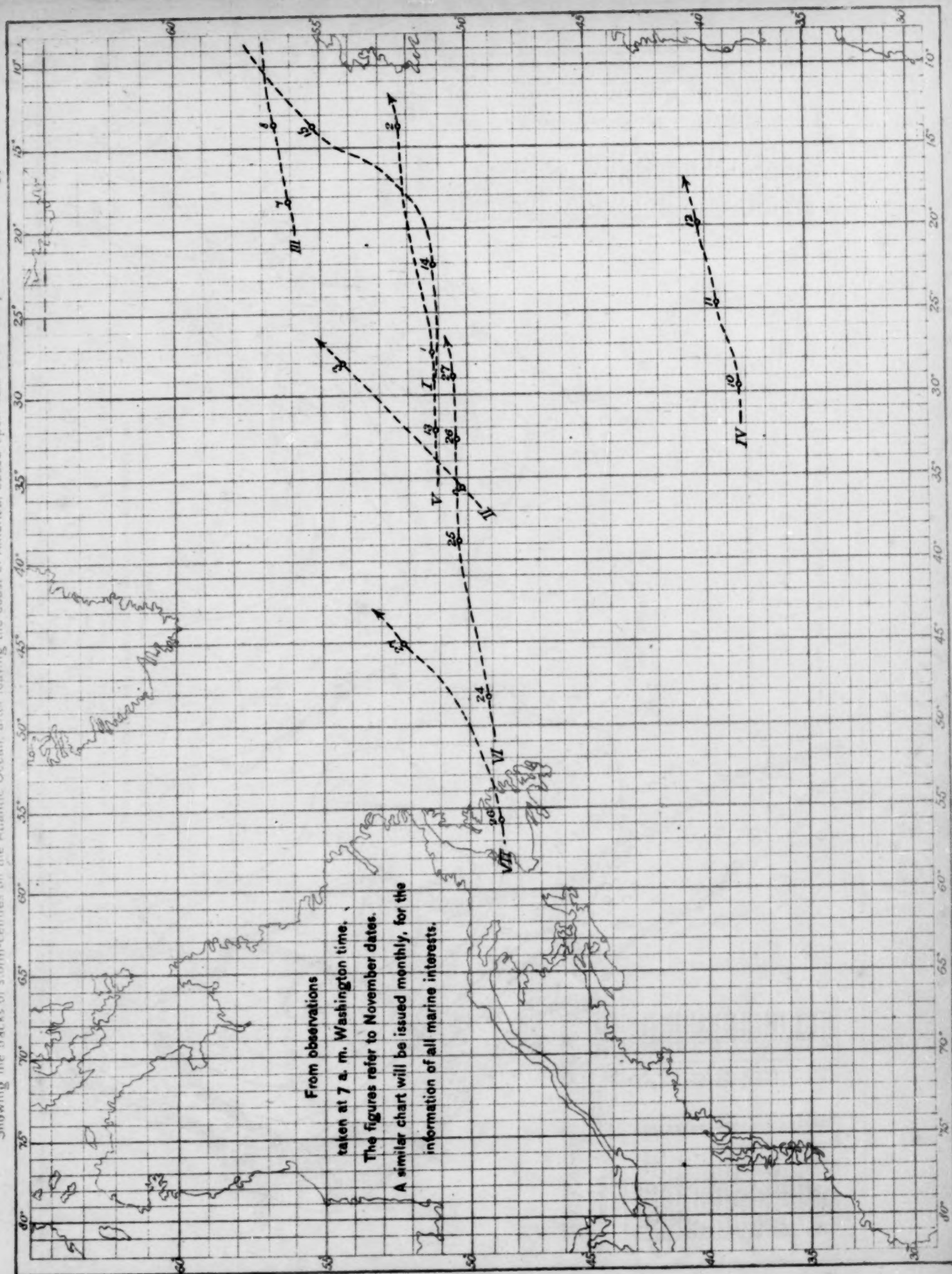
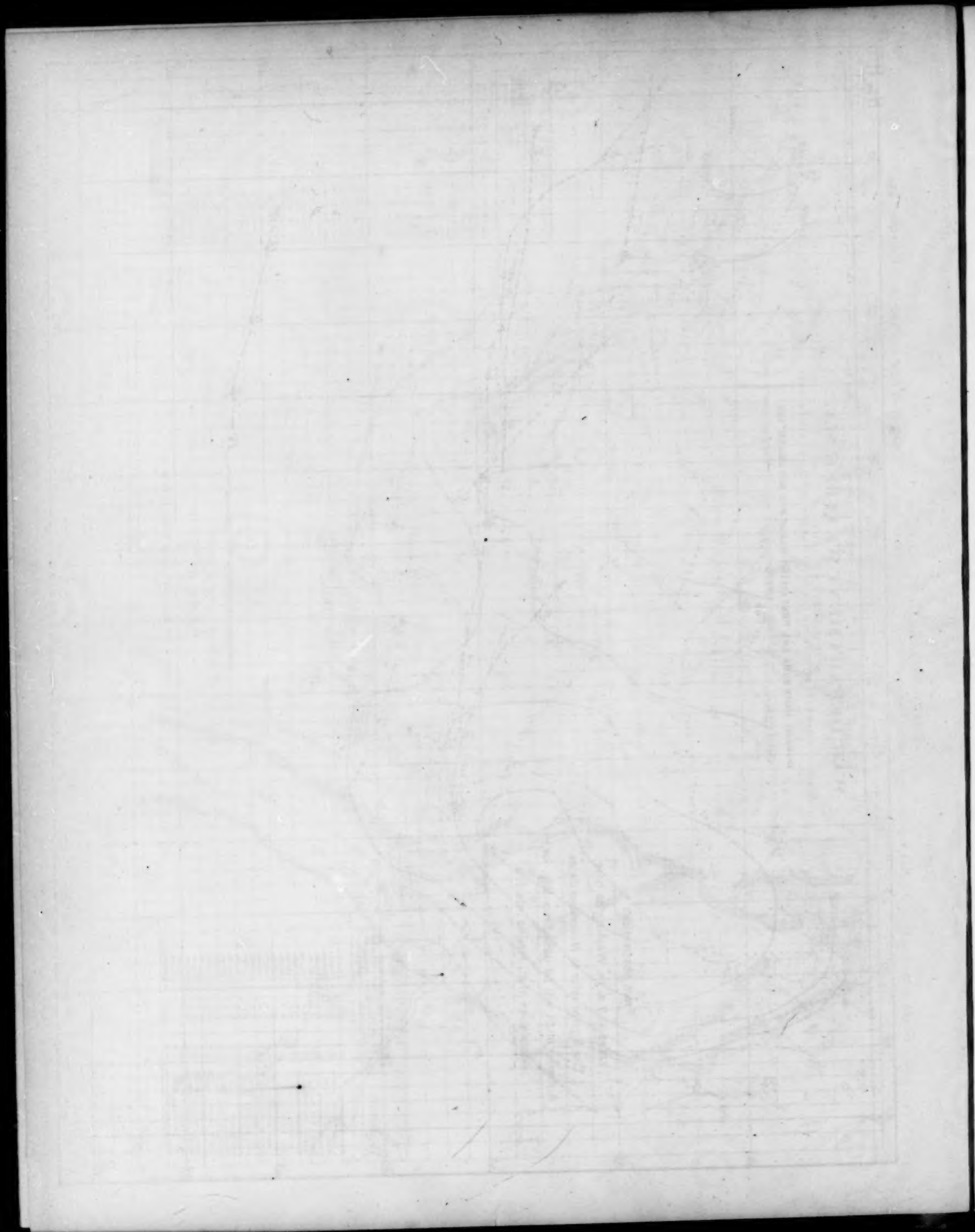


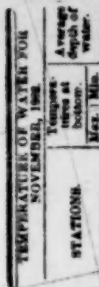


CHART SUPPLEMENTAL TO NO. 1.  
Showing the tracks of storm-centres on the Atlantic Ocean, after leaving the coast of America, based upon data received up to December 25.









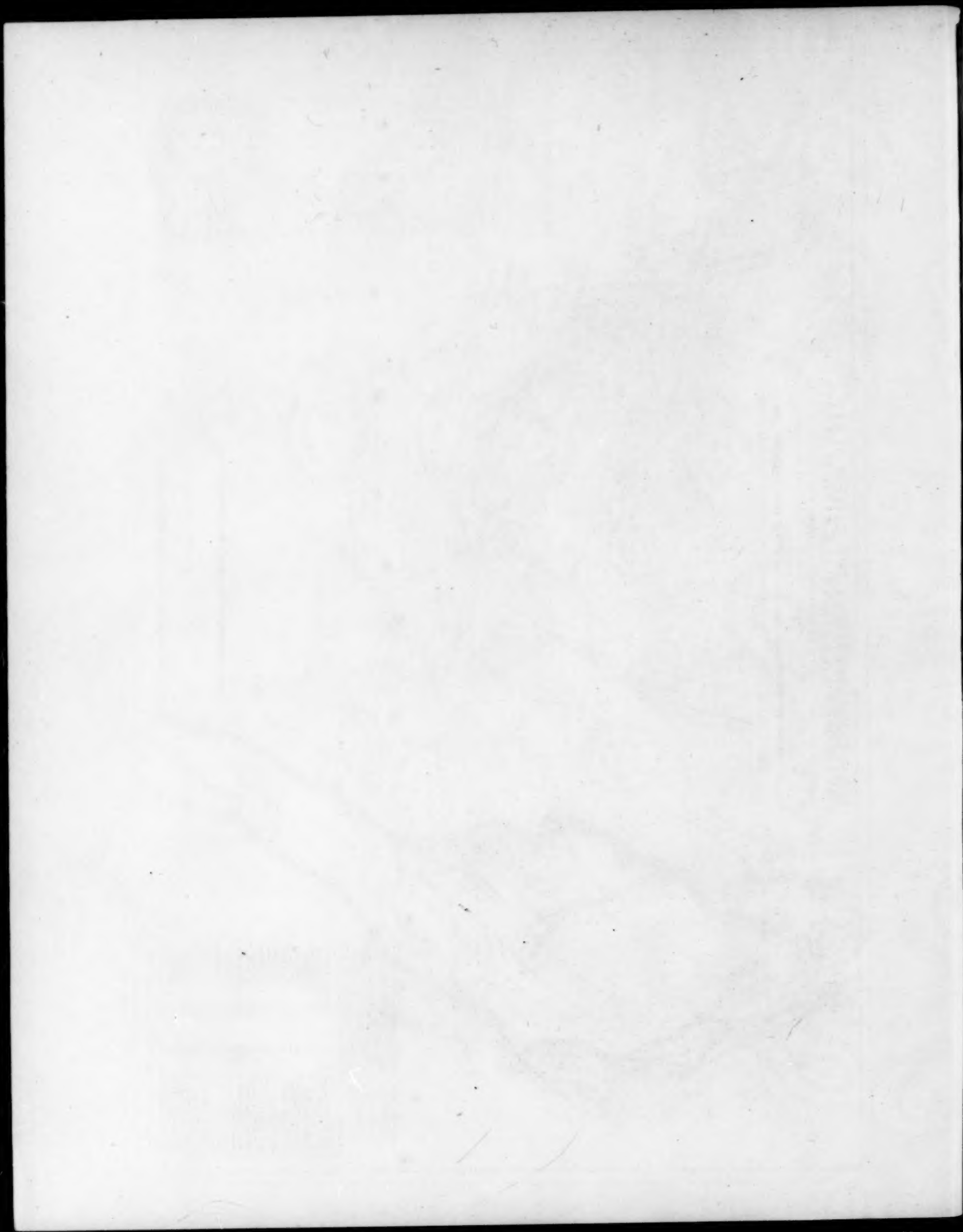
STATIONS.	Tempera- tures at three ft bottom.		Average depth of water.
	Max.	Min.	

PUBLISHED BY ORDER OF THE SECRETARY OF WAR.

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BRIG. & BVT. MAJ, GEN'L, CHIEF SIGNAL OFFICER, U. S. A.

AVERAGE TEMPERATURES FOR NOVEMBER 1892			Comparison of the average for the current year with the average for several years.
DISTRICTS.	Average for Nov. signal service at several years.	For 1892.	
New England.	28.3	28.7	0 below.
Middle Atlantic states.	43.0	44.9	1 below.
South Atlantic states.	55.9	52.1	3 below.
Piedmont.	47.6	48.3	1 below.
Piedmont Highlands.	47.6	48.3	1 below.
Florida Peninsula.	54.9	54.8	0 above.
Western Gulf states.	54.9	54.8	0 above.
Great Gulf states.	46.7	48.3	2 above.
Texas.	47.9	49.7	1 above.
Tennessee.	47.9	49.7	1 above.
This valley.	47.9	49.7	1 above.
Ohio valley.	47.9	49.7	1 above.
Upper lake region.	32.5	32.5	0 above.
Upper lake region.	32.5	32.5	0 above.
Minnesota northward.	32.5	32.5	0 above.
Upper Minn. valley.	34.4	37.4	4 above.
Missouri valley.	35.6	39.3	3 above.
Nebraska valley.	35.6	39.3	3 above.
Black hills.	37.6	39.3	1 above.
Black slope.	37.6	39.3	1 above.
Southern slope.	51.1	51.6	0 above.
Northern plateau.	36.3	31.6	4 above.
Black plateau.	37.6	35.7	1 above.
Black plateau.	37.6	35.7	1 above.
North Pacific coast.	43.9	43.3	1 below.
South Pacific coast.	54.0	50.7	3 below.
North Pacific coast.	56.8	55.5	0 above.
W. Washington.	46.0	46.9	0 above.
Idaho.	36.0	36.9	0 above.
Montana.	36.0	36.9	0 above.
Yellowstone.	36.0	36.9	0 above.
Rocky Mts., Col.	36.0	36.9	0 above.

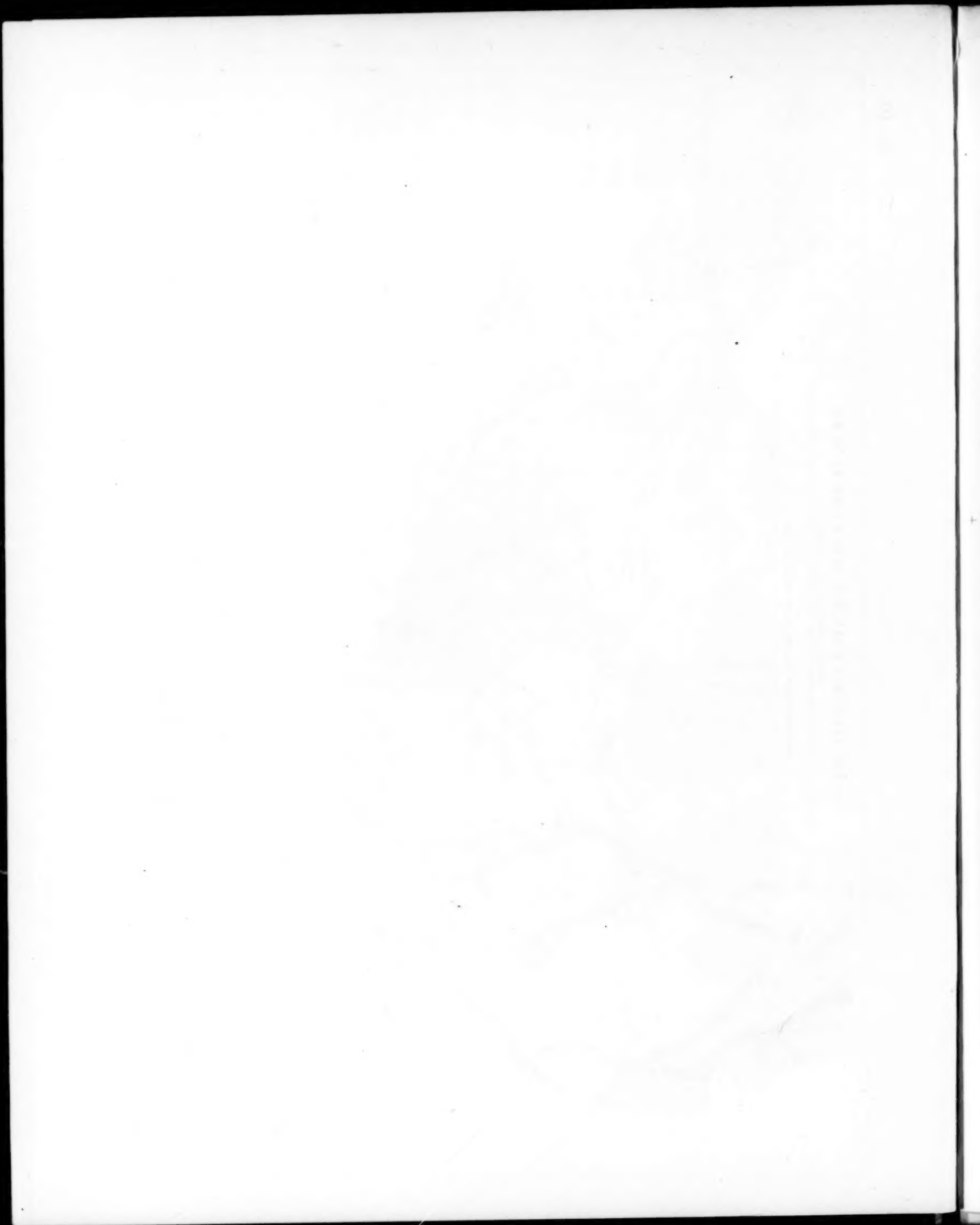




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WILLIAMSON

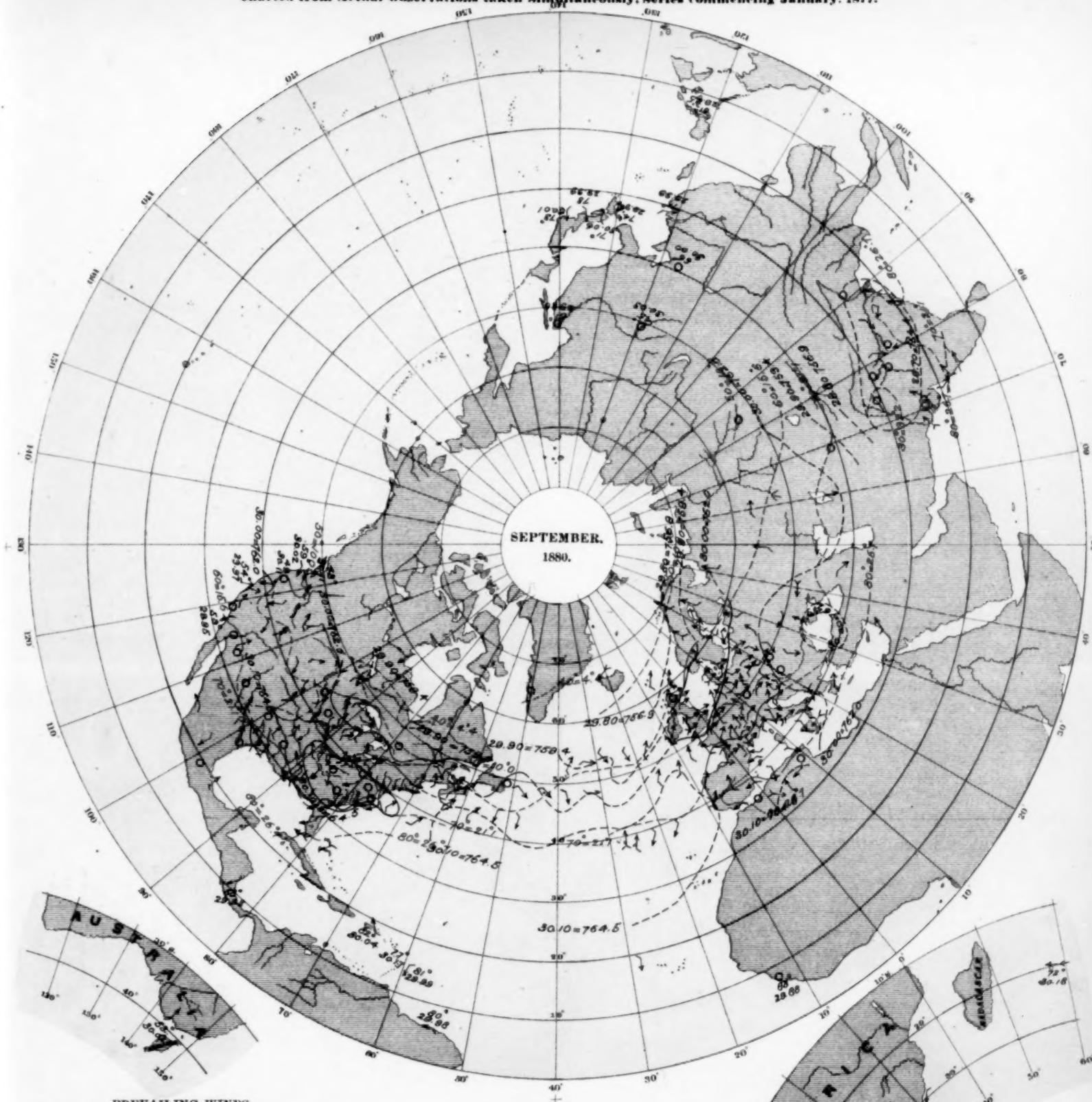
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Office of the Chief Signal Officer,  
UNITED STATES ARMY.  
Charted from Actual Observations taken Simultaneously, Series commencing January, 1877.

No. 4.



PREVAILING WINDS.

Arrows show the direction of, and fly with, the wind.  
Force is shown as follows:

SYMBOLS.	FORCE.	VELOCITY.	
		Miles per hour.	Metres per second.
○	0	0	0
→	1, 2	0 to 9	0 to 4.0
→→	3, 4	9.1 to 22.5	4.1 to 10.1
→→→	5, 6	22.6 to 40.5	10.1 to 18.1
→→→→	7, 8	40.6 to 67.5	18.1 to 30.2
→→→→→	9, 10	67.6 up.	30.2 & over.

PUBLISHED BY ORDER OF THE SECRETARY OF WAR

*W. H. Bryan*

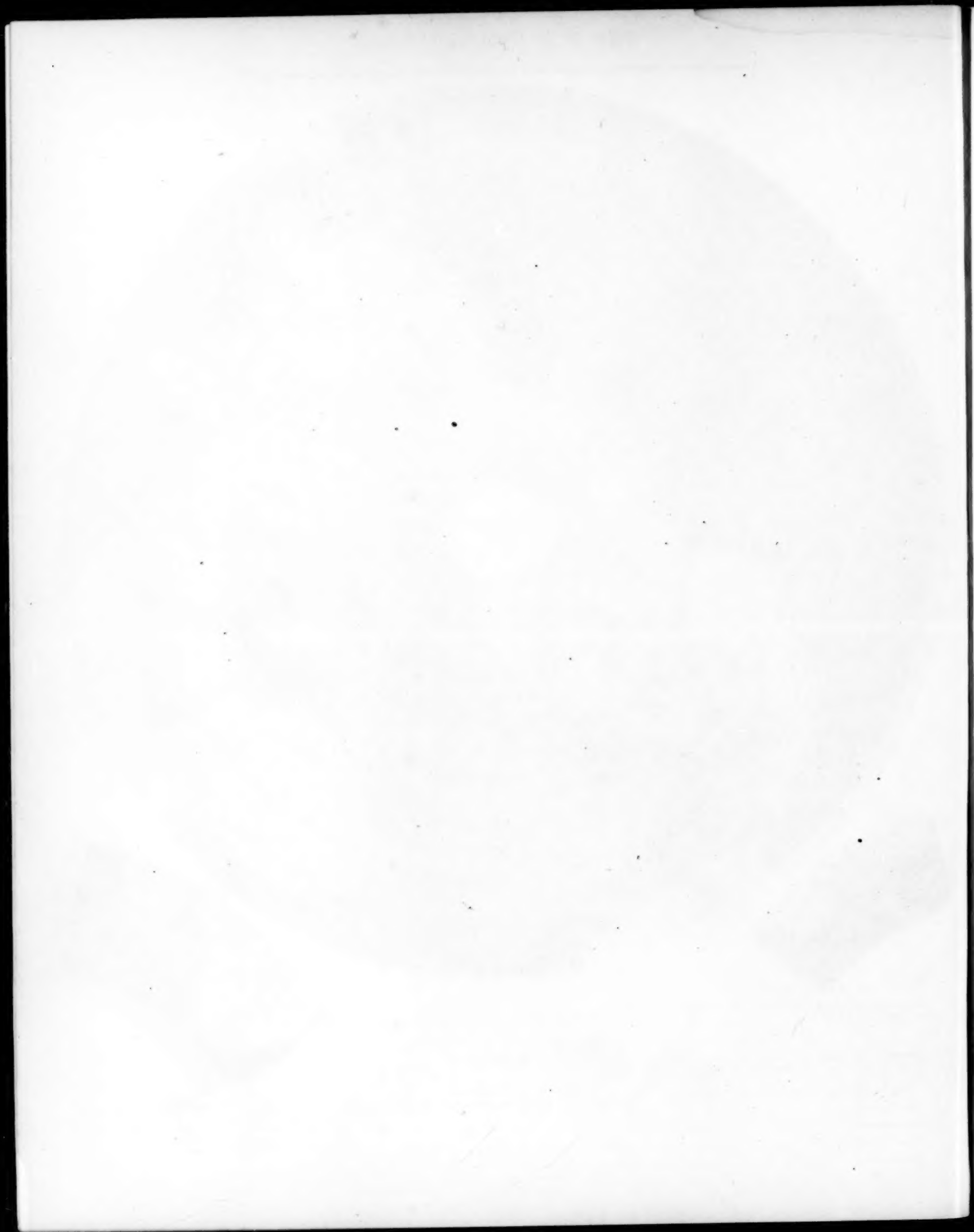
Brig. & Bvt. Maj. Gen'l,  
Chief Signal Officer, U. S. A.

INTERNATIONAL MONTHLY CHART.

Showing mean pressure, mean temperature, mean force and prevailing direction of winds at 7:35 A. M., Washington mean time, for the month of September, 1880, based on the daily charts of the International Bulletin.

ISOBARS AND ISOTHERMS.

Isobars in blue; detached barometer means in English inches.  
Isotherms in red; detached temperature means in degrees Fahrenheit.  
Broken lines, are doubtful.



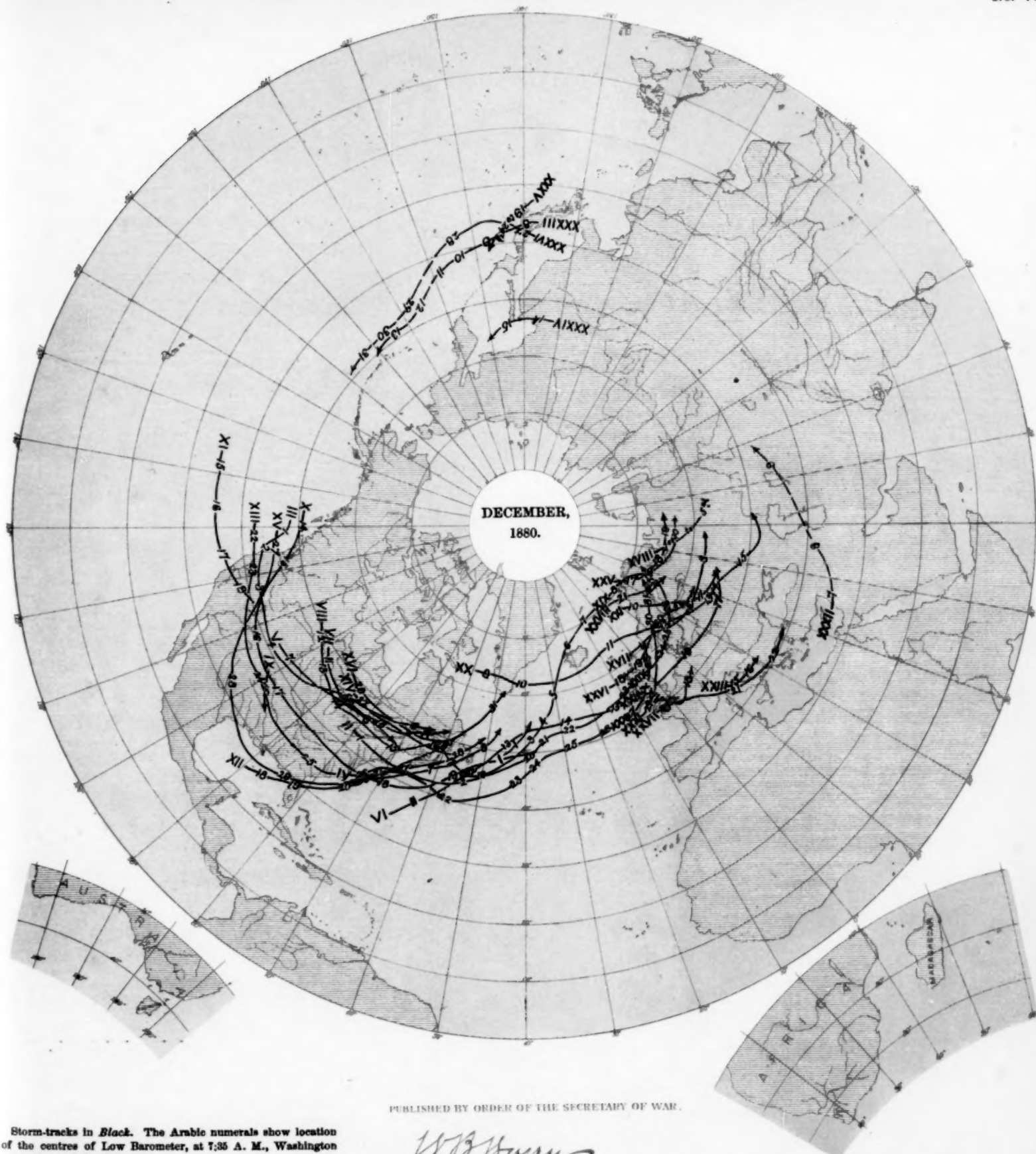


# Office of the Chief Signal Officer,

UNITED STATES ARMY.

Charted from Actual Observations taken Simultaneously, Series commencing November, 1877.

No. V.



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Storm-tracks in *Black*. The Arabic numerals show location of the centres of Low Barometer, at 7:35 A. M., Washington mean time, of that date.

Broken or dotted lines, are doubtful.

INTERNATIONAL CHART.

Showing Tracks of Centres of Low Barometer for December, 1880.